PHILIPPINE CACAO INDUSTRY ROADMAP 2021-2025

DEPARTMENT OF AGRICULTURE
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PHILIPPINE CACAO INDUSTRY ROADMAP 2021-2025

Department of Agriculture

HIGH VALUE CROPS DEVELOPMENT PROGRAM

The Philippine Cacao Industry Roadmap (2021-2025)

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ACRONYMS

ACPC	Agricultural Credit Policy Council
ASEAN	Association of Southeast Asian Nations
BAFS	Bureau of Agriculture and Fisheries Standards
BIST	Business Innovation through Science and Technology
BPI	Bureau of Plant Industry
CIDAMI	Cacao Industry Development Association of Mindanao
CPB	Cocoa Pod Borer
CRADLE	Collaborative Research and Development to Leverage Philippine Economy
DA	Department of Agriculture
DA-HVCDP	Department of Agriculture – High Value Crops Development Program
DA-RFOs	Department of Agriculture –Regional Field Offices
DAR	Department of Agrarian Reform
DENR	Department of Environment and Natural Resources
DOST	Department of Science and Technology
DTI	Department of Trade and Industry
FFC	Fine Flavoured Cocoa
GAP	Good Agricultural Practices
ICT	Information Communication Technology
KFI	Kennemer Foods International
LGU	Local Government Unit
MCDC	Mars Cocoa Development Center
MinSAAD	Mindanao Sustainable Agrarian and Agriculture Development
MPEX	Manufacturing Productivity Extension Program
MRP	Manufacturing Resurgence Program

NCITWG	National Cacao Industry Technical Working Group
NGO	Non-government Organization
NICER	Niche Centers in the Regions for R&D Program
NSIC	National Seeds Industry Council
NSO-FTS	National Statistics Office – Foreign Trade Statistics
PAPs	Programs, Activities, and Projects
PCA	Philippine Coconut Authority
PCAARRD	Philippine Council for Agriculture, Aquatic, and Natural Resources Research and Development
PCIA	Philippine Cacao Industry Association
PCIC	Philippine Cacao Industry Council
PhilMECH	Philippine Center for Postharvest Development and Mechanization
PSA	Philippine Statistics Authority
RDLead	Research and Development Leadership
SBC	Small Business Corporation
SETUP	Small Enterprise Technology Upgrading Program
UPLB	University of the Philippines – Los Bańos
USM	University of Southern Mindanao
VCA	Value Chain Analysis
VSD	Vascular Streak Dieback

MESSAGE

In the wake of unprecedented events and emerging crises, the Department of Agriculture (DA) launched the Plant, Plant, Plant Program to ensure that all Filipino families would have adequate supply of nutritious, healthy, accessible and affordable food to meet the demands of these challenging times.

As a testament of our firm resolve to triumph over this formidable foe, the DA was re-energized to act as one, but is committed at the same time to delivering results from various projects under the different major programs of the Department.

In light of this, I wish to congratulate all the principal actors who paved the way for the crafting and updating of High Value Crops Development Program (HVCDP) Roadmap. Through the completion and publication of this HVCDP Roadmap, we enshrine the spirit of excellence, collaboration, and resilience as inherent characteristics of our agricultural inheritance and legacy.

The progressive cross-cutting and continuing collaboration among all stakeholders in pursuit of attaining competitive advantage and relevant growth is an output designed into the pages of this roadmap.

I am proud and grateful that such a focused work on this commodity could be undertaken to ensure that a brighter future for the industry can reasonably be expected and attained because this blueprint already exists to assure it.

Marami pong salamat at Mabuhay!

WILLIAM D. DAR, Ph.D.
Secretary
Department of Agriculture

MESSAGE

The Philippine coffee and cacao industries play a fundamental role in the socio-economic advancement of our country as they create employment opportunities and promote a culture of quality for local products that highlight the professionalism of our people and services. With coffee and cacao considered high-value crops and emerging agriculture products in the country, it is only imperative that we bridge the various gaps in our supply chain towards a more responsive and globally-competitive coffee and cacao industries.

Throughout the years, the Department of Agriculture (DA) has been an invaluable and dedicated partner of the Department of Trade and Industry (DTI) in this endeavor. Together with the commitment of industry organizations and the participation of our private sector partners and stakeholders, our combined efforts for a more unified action at the national and local levels have provided enabling mechanisms that empower and support the long-term development of farmers.

The updated Philippine Coffee and Cacao Industry Roadmaps serve as guides in improving production while ensuring that the respective industries are cost-competitive, aligned with global quality standards, reliable and environment-friendly, and will provide sustainable benefits to farmers, processors, traders, and exporters. These, in turn, will accelerate the growth of the agriculture sector as we address issues on food security, economic prosperity, and social inclusion for micro, small, and medium enterprises (MSMEs).

As we strengthen and position the Philippine brand of coffee and cacao on the global stage, let us remain steadfast in charting realistic, responsive, and strategic actions in promoting our local produce so that we may be able to secure the sustainable and inclusive growth of our industries and provide a more comfortable life for all Filipinos.

RAMON M. LOPEZ
Secretary
Department of Trade and Industry

FOREWORD

The Covid-19 pandemic that ravaged life and livelihood in the country for almost 2 years now proved to be an existential threat to our way of life. On the positive side, it elicited generosity and a sense of community in all of us, and became a catalyst of change in many areas of our lives.

It is in these multi-faceted circumstances that the High Value Crops & Rural Credit (HVCRC) of the Department of Agriculture (DA), working collaboratively with various stakeholders and industry experts, undertook the needed updating of this industry roadmap as an integral part of the Secretary of the Department of Agriculture, Dr. William D. Dar's 18 transformative strategies, and formulated in alignment to his **One-DA to Transform Vision** of Philippine Agriculture, in order to achieve a Food Secure and Resilient Philippines, with empowered and prosperous farmers and fisher-folk. While this industry roadmap is the handiwork of many minds and multi-stakeholders, in its core it subscribes to the interdependent and inter-related approaches of **Industrialization, Farm Consolidation, Mechanization, and Professionalization** as pillars of its foundation.

This roadmap is envisioned to serve as a guide to all industry stakeholders for the realization of the targets set in it for 2021 – 2025. It is an embodiment of how the industry will achieve its goals of transformative growth through the value chain approach, as well as increase in quality and sustained yields and incomes. It is with pride and pleasure that I express my heartfelt gratitude to everyone both in the private sector and government, who unselfishly lent their time and talent for this timely and necessary endeavor. More than the lofty legacy and memorable milestone we shall leave behind because of this worthwhile work, it is more the comfort in the knowledge that the entire industry would have a clear pathway to follow in the years ahead to realize its vision that is truly more meaningful to remember us all by. Thank you.

EVELYN G. LAVIÑA
Undersecretary for High Value Crops and Rural Credit
Department of Agriculture

PREFACE

Big Congratulations are in order to all high value crops stakeholders in cacao, coffee,mango, banana, vegetables and onions who have successfully updated the commodity roadmaps of the country.

The updating of the high value crop roadmaps addresses the major challenges of our food and agricultural sustainability in the light of climate change and other natural calamities that hit most of our regions in recent memories. We have actively worked on a unified strategic initiative with the premise that agriculture should be a positive contributor to food security, jobs creation and economic opportunities and environmental sustainability.

As head of the Philippine Cacao Industry Council and being an active lead and participant of the cacao industry cluster discussions, this particular roadmap including the rest of the updated roadmaps have outlined the different industry-appropriate frameworks for action to implement multi-stakeholders' solutions that are directly tied to our national agricultural development priorities.

These agricultural roadmaps have carried key messages that the private sector which most of us are ably represented in these industry clusters are able and ready partners and driver of solutions for responsive and sustainable agriculture. Laying down the ground works with government and private sector partners and effective government leadership is an active ingredient for success.

We do hope and pray that these roadmaps will encourage many others to initiate action and strengthen collaborative engagements to achieve our shared goals for sustainable future.

CONSUL ARMI LOPEZ-GARCIA, Philippine Cacao Industry Council
Team Leader
Cacao Industry Roadmap Development Team

EXECUTIVE SUMMARY

The crafting of the revised Philippine Cacao and Chocolate Industry was necessitated to realign its vision, mission, goals, strategies and interventions with the Philippine Republic Act 8435 (Agriculture and Fisheries Modernization Act of 1997), the United Nation's Sustainable Development Goals (UN SDGs), the AmBisyon Natin 2040, the Philippine Development Plan (PDP) and the proposed Philippine Cacao Industry Development Act". This revised roadmap contains new strategies and interventions as well as retain some Action Plans in the 2017-2022 Philippine Cacao Industry roadmap that are deemed relevant and doable but need more push in its implementation. Two of the major revisions made in the existing roadmap are (1) the vision spells out the focus on building strong Philippine branding and (2) anchor the strategies and interventions on the principle of industry clustering, localization and market demands, as well as heightening a context of inclusivity in its scoping and application.

Where are we?

In recent years, the Cacao Industry has been gaining recognition in the domestic and export markets as the supply and demand gap of cocoa beans is increasing. One of the primary drivers of this increase is the growing middle class, increasing discretionary household income in developing countries, new and innovative uses of cocoa in the food, cosmetics and pharmaceutical industries, and the positioning of cacao as health food.

Based on PSA data, the Philippine cacao has a slow but increasing production trend with an average increase of 2,743 ha per year from 2013 to 2020. Such increase may be attributed to area expansion and the seed/seedling dispersal programs of DA, DENR and PCA. However, despite the increasing trend in production, supply still fall short to meet the increasing market demand domestically and globally. Low productivity is due to high mortality of planting materials and the lack of knowledge of cacao growers.

Like most countries that grow cacao, majority of the cacao farms in the country are small holdings and are being owned and managed by farmers. Thus, the need for localization and clustering.

Based on the Food and Agriculture Organization survey in 2017, the Philippines is placed 24th among the top countries producing cacao beans. However, the country placed 72nd in terms of exports with a global market share of less than 0.01%.

The Philippines is a net importer of cacao with an average of USD 168.3-M worth of import but with only USD 22.1-M export value. The large import of cocoa powder and export value of chocolate is being credited to major chocolate manufacturers in the country who seldom buy local cocoa beans. Instead, they use imported powder and cocoa butter for their raw materials.

Based on the recent Philippine Cacao Industry forum, the Philippines has an estimated global demand of about 4.7 million to 5 million metric tons (MT) by 2020. Nonetheless, a cocoa shortage is also predicted at 1 million metric tons (MT). The annual local consumption is at 50,000 metric tons (MT) but the local supply is only around 10,000 metric tons (MT).

With the Philippines' location conducive for cacao production and accessible to domestic and foreign trade, there is a heightened interest among local farmers and exporters to push for a more dynamic and competitive cacao industry that can compete with other major cacao-growing nations.

Moreover, the presence of players from all stages in the cacao value chain places the Philippines at a competitive edge. Another strength of the industry are the support services provided by the enablers in the form of technical and financial interventions, which facilitate the development and strengthening of the industry. Furthermore, the convergence of government support programs and projects touches various levels of the cacao industry value chain and is expected to transform and empower cacao farmers into thriving cocoa communities, which are the essential foundation for sustainable cocoa farming.

Where do we want to go?

To be globally competitive and sustainable cacao industry, efforts should be geared towards the following:

a. Nationwide adoption of the upgraded harmonized cacao production and postharvest protocols to pursue poverty alleviation, job generation and environmental protection while advancing economic development and inclusive growth;

b. Promotion of cacao production in areas highly suitable for cacao growing to improve farm efficiency and ensure increased farmers' income thereby raising their economic status;

c. Promotion of continual applied research and development collaborations;

d. Mobilization of all stakeholders and relevant government agencies to provide the needed extension support services for concerted industry-wide development efforts;

e. Harmonized information gathering to establish a management information system; and

f. Stronger participation in the global cacao and chocolate value chain by building/promoting Philippine Brand.

How do we get there?

One Sector-One Voice is one of the avenues that the cacao stakeholder wants to pursue. Through the leadership of the Philippine Cacao Industry Council (PCIC), in collaboration with the Department of Agriculture (DA), the Philippine Cacao Industry Association, Inc. (PCIA) will be organized and registered at the Securities and Exchange Commission (SEC) as a private organization composed of cacao industry stakeholders. It will serve as the Private sector partner and counterpart of the PCIC in the promotion of the Cacao Industry through the effective implementation of the Harmonized Production and Postharvest Protocols and Action Plans stipulated in the Cacao and Chocolate Industry Roadmap.

Implementation of the revised roadmap will be localized to ascertain timely and up-to-date execution of programs and plans. Yearly review of the roadmap and assessment of milestones will be performed to ensure that the interventions are properly implemented and to make revisions on the course of action, when deemed necessary. Moreover, active participation in local and international events to promote Philippine Brand of quality cacao will be continued as well as forging linkages with international stakeholders will be strengthened.

This revised roadmap is a product of the collective efforts of the cacao stakeholders. Series of meetings and consultations were conducted in crafting this roadmap. This revised roadmap will serve as a guide in the implementation of interventions and the close monitoring of Action Plans. All the stakeholders who participated in crafting this roadmap made a commitment to continue working together to ensure that the short-term goals will be achieved and the medium- and long-term goals be realized.

INTRODUCTION

Rationale

In the recent National Food Security Summit (NFSS), the importance of engaging a wide range of stakeholders in the agriculture value chain was realized as timely feedback can be obtained through them. The updating of the Philippine Cacao and Chocolate Industry Roadmap is aligned in such modality and complies with the Memorandum Order No. 37, Series of 2021 by the Office of the Secretary of the Department of Agriculture. This revised roadmap gives emphasis on the active participation of all stakeholders especially the private sector, and stresses the need for a Unified Action at the national and local level. The significance of harmonizing all efforts from production to marketing at the regional and local level was further elaborated in its strategies and Action Plans. Hence, this updated roadmap will serve as a guide in improving production as well as strengthening and positioning the Philippine brand of cacao and chocolate industry to be globally competitive.

But why invest in Cacao? Basically, cacao may significantly contribute to poverty alleviation and inclusive growth through livelihood and job generation. This is because cacao production only requires a small monetary investment or start-up capital. This explains why 90% of the growers are of small farm holdings. The suitability of cacao as an intercrop for coconut and banana, the two-week harvest interval, and an early gestation period of 18 months are some of the most valued advantages of this high value crop. The early return of investments and high profitability of the product also ensure good income augmentation potential. Moreover, cacao is considered one of the world's most valuable crops. It is a multi-million-dollar industry that has an increasing global and domestic market demands. Above all, the industry is market-driven considering that cacao has no product substitute. The gaining popularity of cacao products not only in the chocolate industry but also in cosmetics and pharmaceutical industries could not be over-emphasized. Hence, cacao's diversified usage as food and non-food warrants a sustainable market opportunity.

On the other hand, cacao industry also faces some hurdles and challenges that need to be addressed as shortage of supply due to low productivity has been observed. This is one of the reasons why an updated roadmap needs to be crafted.

Following the guidelines set in the Philippine Republic Act 8435 (Agriculture and Fisheries Modernization Act of 1997), the United Nation's Sustainable Development Goals (UN SDGs), the AmBisyon Natin 2040, the Philippine Development Plan (PDP), and the One DA Reform Agenda: Key Strategies along with addressing the issues and constraints raised by stakeholders, this updated roadmap will outline how the Philippines may address the following challenges:

a. At the regional level, crafting harmonized production and postharvest protocols and strengthening technical support to ensure that Good Agricultural Practices (GAP) leading to excellent cacao bean quality is adopted;
b. At the national level, improving farm productivity and efficiency to increase farmer's income;
c. At the global level, expanding Philippine presence in cacao-chocolate industry by building and promoting Philippine Branding to be globally competitive.

Objectives

The general objectives of this roadmap are to harmonize the production and postharvest practices of cacao growers and to establish Philippine brand in the global market. To achieve these objectives, interventions will be focused on the following directions:

- Expansion of production areas in areas suitable for cacao growing based on the Climate and Soil Suitability Map
- Increase in fermented bean productivity level
- Moving Up of the Cacao Industry Value Chain
- Strengthening of Market Presence through Branding
- Focus on Fine Flavour Beans Market
- Apply the principle of clustering, localization and market demands

Moreover, the strategies and Action Plans are geared towards meeting the following specific objectives:

- Ensure availability and accessibility of quality cacao planting materials;
- Rehabilitate existing aging trees;
- Increase production areas;
- Raise crop yield to 2 kg/tree/year;
- Ensure availability of high-quality fermented cocoa beans to support and sustain value-adding activities;
- Contribute to the goal of attaining inclusive growth and poverty alleviation

Definition of Terms

- **Agri-preneurship** – refers to the application of the principles of entrepreneurship to agriculture.
- **Geo-tagging** – is the process of adding geographical information through the use of pictures, videos, websites, and other media channels in the form of metadata. This comprises latitude and longitude, altitude, bearing, and a range of other location-specific data.
- **Good Agricultural Practices (GAP)** – are practices that address environmental, economic and social sustainability for on-farm processes, and result in safe and quality food and non-food agricultural products.
- **High-Value Crop** – refers to high-yielding crops that provide competitive returns on investment per hectare. These crops generate potential opportunities in the domestic and international markets and command high prices.
- **Intercropping** – refers to growing two or more crops in the same field at the same time
- **LGU-recognized model farm** – a recognition given by LGU to a cacao farm that showcases the advantages and benefits of adopting GAP in growing cacao and hopefully inspire other cacao growers to adopt GAP

- **Monocropping** – refers to the practice of growing only one crop in the same land season after season.
- **Non-self-pollinating** – is a feature of plants in which they do not have the ability to fertilize themselves. Vectors (insect or wind) are required to facilitate pollination. (Cross-pollination needs a pollinator or the wind to get the pollen to another flower of the same species.)
- **One Sector-One Voice** – strengthening PCIC/PCIA to serve as the voice of the Cacao Industry
- **Pod-index** – the number of pods needed to produce a kilogram of dried beans
- **Quality planting materials** – grafted and scions coming from certified mother trees; planting materials asexually propagated using propagules/scions from NSIC registered cacao trees.
- **Single-origin chocolates** - are made from cocoa beans produced in a specific country, region or even a specific plantation. Due to the climate and soil, together with the techniques of cacao farming and harvesting, origin chocolates have its own signature flavor profile.
- **Supply chain** – refers to the network of individual and/or organizations from the delivery of raw materials from the supplier to the manufacturer until the product's delivery to the end user.
- **Value chain** – characterizes the full range of activities necessary to create a product or service, which allows businesses to determine competitive opportunities.
- **Varietal improvement** – refers to improving the characteristics of current varieties.

INDUSTRY SITUATION AND OUTLOOK

Product

Theobroma cacao, the scientific name of Cacao, literally translates as "food of the gods" in Greek. The name *Theobroma cacao* was first given to the cocoa tree by Carolus Linnaeus – the Father of Modern Day Taxonomic Plant Classification. Cacao is the Mayan root word to describe the tree and its product. It is grown mainly for its seeds known as the cocoa beans which are used to make cocoa mass, cocoa powder and chocolate.

In the Philippines, there are three major cultivar groups being grown by farmers. Each cultivar possesses its unique properties and qualities. These cultivars are:

The ***Criollo*** is considered as the most prized, rare and expensive variety. It is native to Central and South America. It is believed that the first cacao seed planted in the Philippines was the Criollo variety brought via the Acapulco-Manila Galleon Trade in 1670. Only 5% of the world's cacao production is Criollo because it is extremely susceptible to pests and diseases, thus difficult to grow. The beans are white to pale pink in colour and recognized as a superior quality, less bitter and more aromatic. Considered as the "Prince of Cocoas," Criollo is an ingredient in premium chocolates.

The ***Forastero***, a native of the Amazon basin, is the most versatile variety and most commonly grown cocoa. It is mainly grown in Africa, Ecuador and Brazil and accounts for 80% of the world's cocoa supply. It is significantly harder, disease resistant and high yielding. Beans are purple-coloured and mainly used to give chocolate its full-bodied flavor. They have bitter taste, thus often blended with superior cocoas.

The **Trinitario**, a crossbreed variety of Criollo and Forastero, combines the best qualities of the two varieties: the hardiness and high yielding traits of Forastero and the refined taste of Criollo. It is the predominant fine flavour cocoa and is being used in about 10% of the world

cacao supply. Trinitario can be found in all the countries where Criollo cocoa was once grown including Southeast Asia and the Philippines. About 70% of Philippine production is Trinitario.

The soil and water composition differ in different locations, thus identical varieties of cacao may taste differently. Like wine sources, cacao bears the distinct flavor of the land where it originates.

Cacao is said to be a non-self-pollinating plant thus scientists and industry experts are recommending to have at least 3-5 clones in one farm site to facilitate pollination. In the Philippines, there are 13 approved varieties/clones registered in the National Seeds Industry Council, to wit: UF 18, BR 25, K 1, K 2, PBC 123, K 9, ICS 40, UIT 1, DR 1, P 7, S 5, USM Ch 1 and USM Ch 2. Of these major clones, six (6) are prevalently used, namely: UF18, PBC123, BR25, K1, K2 and K9. Among the six clones, UF18, BR25 and PBC123 are seen to have high performance and great potentials in the market. These clones possess the following traits: early maturing, early fruit-bearing, high-yielding, high fat content, tolerant to Vascular Streak Dieback (VSD) and have an average pod index of 20-34.

Product Forms

Cacao is the main ingredient that has no product substitute in chocolate production. There are six (6) intermediate products that can be derived from cacao beans: cocoa nibs, cocoa liquor (tablea), cocoa cake, cocoa butter, cocoa powder and chocolate confectionary blocks. These products gained popularity not only in the chocolate industry but also in cosmetics and pharmaceutical industries. Hence, cacao's diversified use for food and non-food industries provides broader market opportunities. As a health food, cacao is considered as a super food as it is packed with vitamins, antioxidants and essential minerals such as magnesium, calcium and iron.

Cacao products come in different forms, which can be differentiated as follows:

a. **Cacao Nibs** are made from fermented and dried cacao beans, which are de-hulled then broken into smaller pieces. They contain the whole cacao bean, thus possess the full flavor that cacao has to offer.

b. **Cacao Paste**, known as cacao liquor, is made from milling whole cacao beans into a creamy, rich paste. The paste is allowed to solidify into a solid block, which can also be considered 100% chocolate as it contains only pure, whole cacao beans.

c. **Cacao Butter** is the combined butter made from all of the fat-based components in whole cacao beans. This is made by pressing the milled cacao beans to separate the cacao butter from non-fat cacao mass or solid.

d. **Cacao powder** is obtained from milling whole cacao beans and pressing them to remove the fat content. The milled cacao mass can then be grounded into a fine powder.

e. **Cacao beans** are the raw form, which can be sold as wet or dry and fermented. It can be heat treated by roasting, to produce cocoa-based products.

Cocoa-based products traded in the local and international market include:

- Wet cacao beans
- Ready to sow cacao seeds (seedling purposes)
- Cocoa nibs (beans, whole/broken, raw/roast
- Tablea (Cocoa paste or liquor, not defatted)
- Cocoa powder (not containing added sugar/other sweetening matter)
- Cocoa butter, fat/oil
- Chocolates
- Chocolate Confectionery

On the other hand, some of the by-products that can be derived from cacao are as follows:

a. **Cocoa Pulp Juice**, also known as sweatings, is a whitish liquid extracted from wet cocoa beans. It contains predominant minerals such as potassium, sodium, calcium and magnesium. The pectin obtained from cocoa pulp juice is comparable with pectins that are derived from apples and lemons. Fermentation of the sugars in sweatings may lead to the production of alcoholic drinks, such as gin and brandy, as well as production of wine and vinegar.

b. **Cocoa Pod Husk** (CPH) is the leftover pod material of matured cocoa fruit after the wet beans, sweatings and placenta have been removed. By-products that can be derived from CPH are as follows:

    i. **Briquettes** - dried cocoa pod husk is compressed to form a brick-shaped mass used for fuel. It is environment-friendly and has a high heating element.

    ii. **Animal feed** – CPH is incorporated into animal feeds for pigs, poultry and livestock, and is blended in tilapia feed.

    iii. **Alkali** - CPH ash can be used as a source of alkali for soap making.

    iv. **Fertilizer** - CPH ash can also be converted into a potassium-rich fertilizer by adding starch and pelletizing the mixture.

c. **Cocoa Bean Shell** is the seed coat removed from the cocoa beans, which can be used as a mulch.

d. **Cocoa butter extracted from discarded cocoa beans** may be used in the production of toilet soap, soft soap and body pomade.

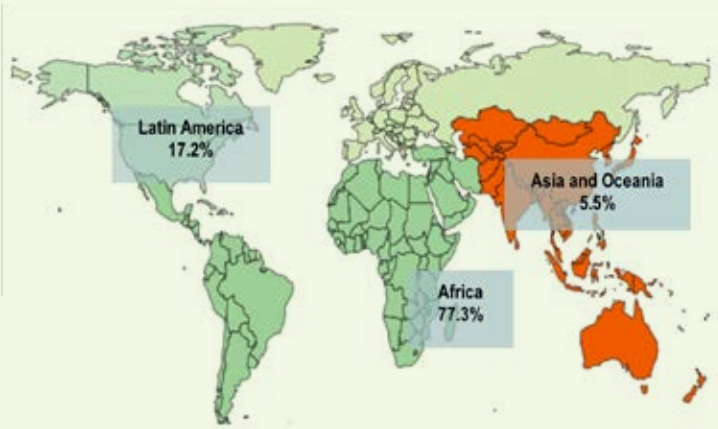
The processing of cocoa waste into the above-mentioned by-products will not only help preserve the environment but also has the potential to augment cocoa farmers' income. Continual research and development are being undertaken to further assess the viability and profitability of the above-mentioned by-products. Likewise, new initiatives are being done to develop other by-products that can be derived from cocoa waste.

Cacao Production

Cacao is a perennial crop that grows in tropical environments, mostly concentrated in a region called the Cacao belt, which is anywhere within 20 degrees north or south of the Equator. It grows most notably in Central and South America, West Africa and Southeast Asia specifically Malaysia, Indonesia and the Philippines. The climate conditions in these areas are well suited for growing cacao trees. The tree is often grown under the shades of other trees and can be as tall as 40 feet. It typically bears fruits in 18 months but reaches full bearing capacity in 5 years producing 70 to 100 pods or more per tree per year. The suitability of cacao as an intercrop for coconut and banana and the two-week harvest interval are some of the most valued advantages of this high value crop.

The tree is cultivated in many countries. Africa contributes 77.3% of the world cacao production, followed by Latin America (17.2%) while Asia and Oceania at 5.5%. At present, the leading suppliers of cacao are Ivory Coast, Ghana, Indonesia, Nigeria, Cameroon, Brazil, Ecuador, Peru, Dominican Republic and Colombia.

FIGURE 1: MAP SHOWING THE MAJOR PRODUCTION AREAS OF CACAO IN THE WORLD



Source: ICCO Quarterly Bulletin of Cocoa Statistics, Cocoa year 2020/21, August 31, 2021

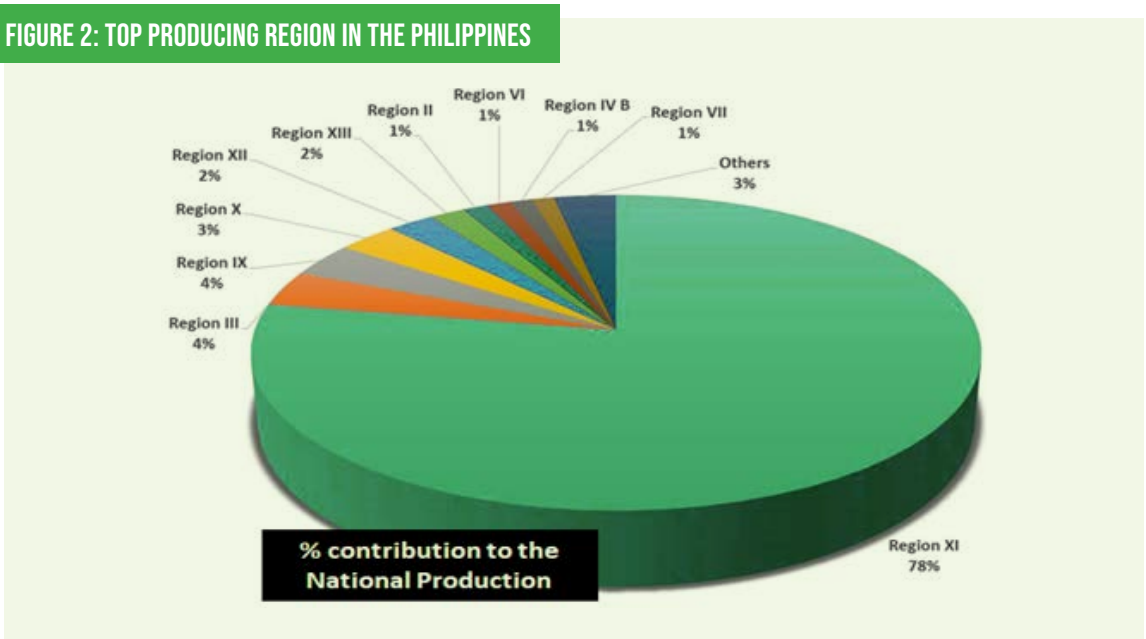
Ninety percent (90%) of existing cacao farms are small. This ownership profile holds true even in the global scenario where most cacao farms are also small, ranging from 1-3 hectares.

According to the Global Market Report for Cocoa (2019), global supply was able to keep up with the demand in the recent years, with a small excess in 2018. However, The Economist Intelligence Unit still forecasts insufficiency in supply in the long-term due to low yield and prices. Among the production constraints faced by the suppliers are wild weather pattern, pests and diseases, competition with other plantation crops, aging of cacao trees in major production areas, and low productivity level. Other factors involved are social unrest/civil war, low investments in postharvest and limited production inputs.

Local Production

In the Philippines, most cacao growing areas are located in the Mindanao island. As illustrated below, the Davao Region contributes 78% of the national cacao production having 7,257.85 metric tons (MT) planted in 19,975 hectares of land in 2020. The rest of Mindanao contributes almost 90% while the remaining 10% is being shared by Luzon and Visayas.

FIGURE 2: TOP PRODUCING REGION IN THE PHILIPPINES



Nine of the top ten producing provinces are located in Mindanao island and one in the Luzon island. Though majority of the top producers are in the Mindanao island, it is noteworthy to recognize that Luzon and Visayas islands are continuously encouraging new growers and existing growers to expand its areas thereby predicting to increase its contribution in the overall cacao production in the future. Currently, the top producing

provinces in Luzon and Visayas are Aurora, Palawan, Iloilo and Bohol. The highest producers in Luzon and Visayas are Aurora province and Iloilo with 333.91 metric tons (MT) and 82.46 metric tons (MT) production, respectively.

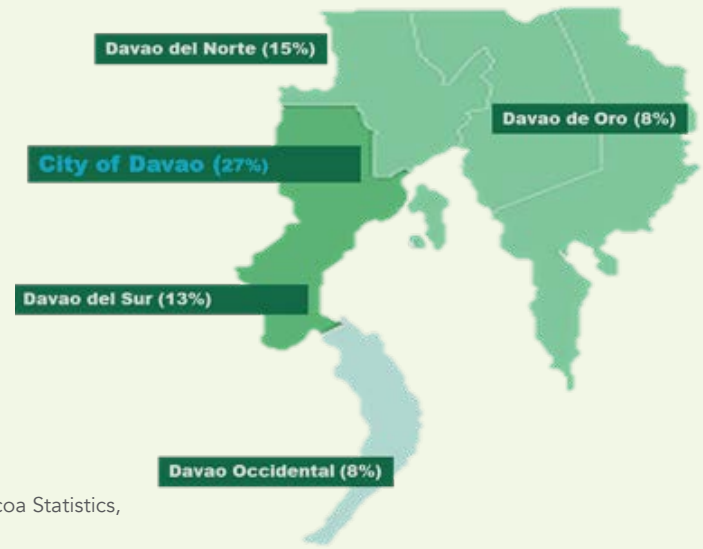
TABLE 1: TOP CACAO-PRODUCING PROVINCES IN THE PHILIPPINES

Province	2020 Volume of Production (MT)	Area Planted (HA)
City of Davao	2,508.98	5,458
Davao del Norte	1,435.59	5,999
Davao del Sur	1,247.93	915
Davao Occidental	750.33	585
Davao de Oro (Compostela Valley)	741.68	5,580
Davao Oriental	573.34	1,438
Aurora	333.91	182
Zamboanga del Norte	282.02	1,502
Bukidnon	185.04	158
North Cotabato	138.31	1,800

Source: OpenStat, Philippine Statistics Authority (PSA), 2020

Figure 3 shows that in Davao region, the City of Davao has contributed the highest production in 2020 with a record of 2,508.98 metric tons (MT), which is equivalent to 27% of Davao region's contribution nationwide. It was followed by Davao del Norte and Davao del Sur with 15% and 13% contribution, respectively.

FIGURE 3: MAP SHOWING THE CACAO PRODUCTION OF THE DAVAO REGION



Source: ICCO Quarterly Bulletin of Cocoa Statistics, Cocoa year 2020/21, August 31, 2021

AREA PLANTED/HARVESTED

The first cacao in Asia was planted in the Philippines in 1670 while commercial farms were established in the 1950s. Production level reached 35,000 metric tons (MT) by 1990. However, production started to decline due to several factors such as typhoon, pests and diseases infestation, aging trees and possible genetic deterioration on commonly used varieties. The decline was further aggravated by decreasing world market price and competition with other plantation crops such as banana and palm oil, which led to a shift on planting preferences.

Despite its competitive advantage, the Philippine cacao production at present only stands at 9,340.73 metric tons (MT) from the 31,285.36 hectares of land planted with cacao based on the figures released by the 2020 Philippine Statistical Authority (PSA).

Around 77,648,326 pieces of seedlings were distributed and planted through the programs of Department of Agriculture-High Value Crops Development Program (DA-HVCDP), the Department of Agrarian Reform (DAR), the Department of Environment and Natural Resources–National Greening Program (DENR-NGP), and the Philippine Coconut Authority-Kaanib Program (PCA-Kaanib Program). About twenty million (20M) planting materials were distributed from 2016 to 2020 through the Department of Agriculture-High Value Crops Development Program (DA-HVCDP). However, monitoring was not regularly conducted, resulting in inaccurate and outdated data, which need to be addressed immediately. High mortality on the planting materials distributed and inefficient procurement and distribution system of planting materials were also identified as issues. Most of the materials distributed in the past did not thrive because of its untimely distribution and the seedlings were not yet mature when distributed.

TABLE 2: PLANTING MATERIALS DISTRIBUTED PER GOVERNMENT PROGRAM

Year	DA-HVCDP	DAR	DENR-NGP	PCA-Kaanib
2010-2020	24,940,910	1,628,556	39,571,832	11,507,028

The seedling dispersal programs could have provided a big push for the industry if proper trainings were provided to beneficiaries and appropriate production protocols were observed. For this reason, the Harmonized Production and Postharvest Protocols for cacao is currently being crafted.

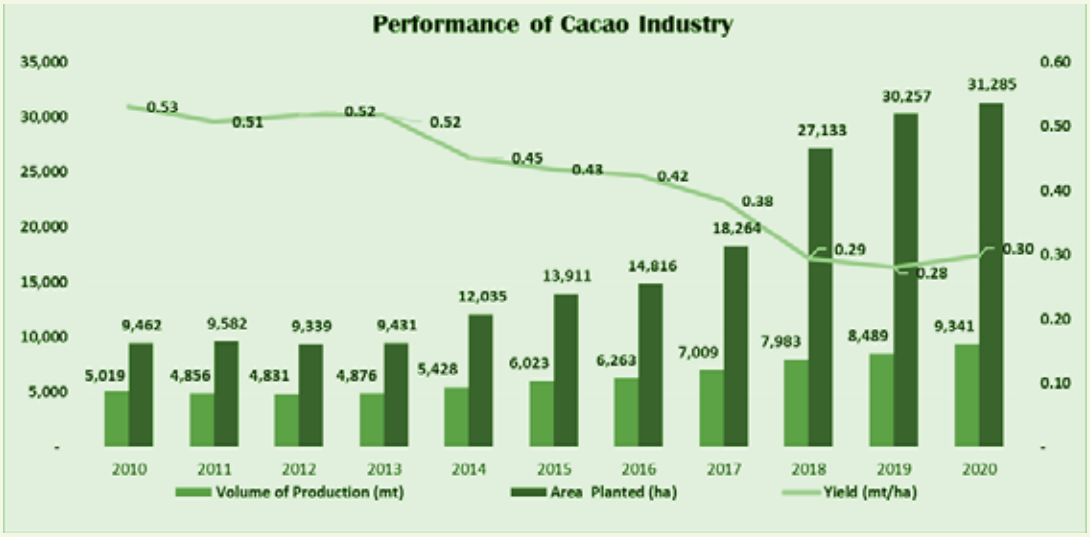
TABLE 3: VOLUME OF PRODUCTION AND AREA PLANTED/HARVESTED

Year	Volume of Production (MT)	Area Planted/Harvested (HA)
2010	5,019	9,462
2011	4,856	9,582
2012	4,831	9,339
2013	4,876	9,431
2014	5,428	12,035
2015	6,023	13,911
2016	6,263	14,815
2017	7,009	18,264
2018	7,983	27,133
2019	8,489	30,257
2020	9,341	31,285

Source: OpenStat, Philippine Statistics Authority (PSA), 2010-2020

Table 4 shows that there was a slight decrease in area planted for cacao from 9,582 to 9,339 ha in 2011-2012 due to high number of mortality rate. However, a gradual increase in area planted was observed in 2013 up to 2020 from 9,431 to 31,285 ha, which accounts for an average increase of 2,743 ha per year. Such increase could be associated with the DA, DENR and PCA seedling dispersal programs as well as the increasing interest of private sectors in cacao growing. Despite an increase in hectarage of cacao farm, the cacao production only increased slightly with an average volume of 563 metric tons (MT). As of the 2020 PSA release, there are 6 million cacao bearing trees planted nationwide. This may be attributed to the unclear data on how many trees have been planted in a hectare to match the computation for the expected production. It is therefore recommended that in conducting data gathering, the number of trees instead of hectarage should be collected in order to reflect a more realistic scenario of cacao production.

FIGURE 4: PERFORMANCE OF CACAO INDUSTRY, CY 2010-2020



YIELD

Despite the availability of high-yielding varieties of cacao, the 2.0 kg per tree yield performance has not been achieved in most farms. This is due to the limited supply of quality planting materials and lack of trainings on good agricultural practices.

In spite of the availability of high-yielding varieties, area expansion and planting material distribution initiatives, the yield has declined from 0.53 metric tons (MT) per hectare (ha) to 0.30 metric tons (MT) per hectare (ha) during the period of 2010 to 2020. The volume of production at 0.5 kg to 1.0 kg per tree per year was observed, which is way below the targeted 2 kg per tree per year yield performance set by the industry to beat the 2022 Cacao Challenge. The genetic expression of the existing varieties is expected to produce 3.5 kg per tree per year.

Aging cacao trees, possible genetic deterioration on commonly used varieties, lack of good agricultural practices, and scarcity of high-yielding planting materials are among the factors affecting the yield and production volume of the industry. Thus, aside from expansion area and provision of inputs, massive rehabilitation/rejuvenation of old cacao trees is strongly recommended to increase yield. An estimate of 19 million trees also need to be fertilized with an expected yield of 39 metric tons (MT) by 2025.

The Philippine Coconut Farmers and Industry Development Plan (CFIDP) includes a collaborative effort in the implementation of the Coconut-Coffee/Cacao-Based Enterprise Development project under the Republic Act No. 11524 otherwise known as the Coconut Farmers and Industry Trust Fund Act. This targets to rehabilitate about three (3) million cacao trees over a five-year period, expand the priority cacao area to 7,300 hectares over five years, and establish cacao nurseries with production training to achieve a capacity of 10,000 seedlings per year. The goal of this project is to group farmers into clusters, create long-term jobs, and conserve natural resources. Farmers-owners will be the direct beneficiaries of this project, while tenants, laborers, and caretakers will benefit as skilled farm and processing service providers/workers.

A total of 2,982,676 cocoa trees to be rehabilitated/rejuvenated across all regions. There are 7,601 hectares accessible for intercropping growth across the country. In addition, 84 nurseries will be established to ensure the availability and accessibility of planting materials while also lowering seedling mortality rates. This will be done in collaboration with the High Value Crops Development Program (HVCDP) and the Bureau of Plant Industry (BPI) in conducting trainings for proper nursery operation and management. To serve its members and any interested clients, these nurseries must produce a minimum of 10,000 trees once they begin operations.

In addition, intercropping coconut and cacao might help meet the roadmap's targets of 3,792.98 metric tons by 2025 and 10,362.33 by 2028.

Consumption

According to the recent Philippine Cacao Industry forum, the Philippines has an estimated global demand of between 4.7 million to 5 million metric tons (MT) by 2020, however, a cocoa shortage is also predicted at 1 million MT. The annual local consumption is at 50,000 metric tons (MT) while the local supply is around 10,000 metric tons (MT). In order to address the underutilization of the capacity of local grinders, it is evident that the expansion and strengthening of the production aspect of the industry be given emphasis.

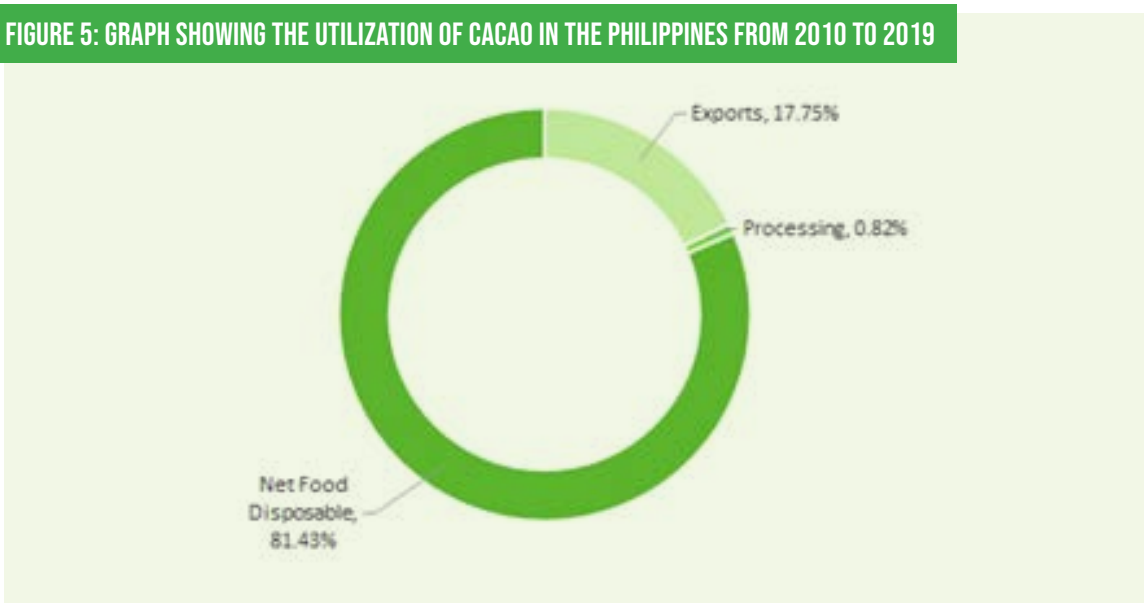
The growing number of restaurants and coffee shops serving cocoa-based drinks and food items, and the growing industry of medium and small-scale chocolatiers requiring high quality cocoa beans contributed to the attractive price of cacao in the domestic market. Moreover, changes in consumer preferences such as increasing consumption of "Tsokolate" (Tablea) drinks and chocolates, and increasing purchasing power of middle-aged working class pose opportunities for manufacturers of tablea and chocolates including cocoa beans producers.

TABLE 4: UTILIZATION OF CACAO IN THE PHILIPPINES FROM 2010 TO 2019

Year	Exports	Processing	Total Net Food Disposable	Per Capita Consumption (kg/year)
2010	181	76	7,485	0.08
2011	124	50	4,984	0.05
2012	298	47	4,634	0.05
2013	498	72	7,138	0.07
2014	1,770	65	6,431	0.06
2015	1,804	62	6,118	0.06
2016	2,233	60	5,911	0.06
2017	3,094	70	6,952	0.07
2018	2,733	75	7,412	0.07
2019	3,049	66	6,497	0.06

Source: OpenStat, Philippine Statistics Authority

FIGURE 5: GRAPH SHOWING THE UTILIZATION OF CACAO IN THE PHILIPPINES FROM 2010 TO 2019



Based on the Supply and Utilization Accounts data generated by the PSA, a Filipino consumed an average of 0.063 kg of cacao per year for the 10-year period (2010-2019). It can be observed that the per capita consumption dropped from 0.08 kg/year in 2010 to 0.06 kg/year in 2019. The average volume of imports during the period is 23% of the total supply of cacao in the country.

On the other hand, cacao intended for exports generally increased over the years, from 181 metric tons (MT) in 2010 to 3,049 metric tons (MT) in 2019. The drastic increase started in 2014 wherein eight (8) Filipino firms participated in the cocoa-chocolate global value chain. On the average, 17.75% of the cacao supply in the country was exported. Meanwhile, volume intended for processing exhibit volatility. The average volume allotted for the said activity is just 0.82% of the total available supply in the country.

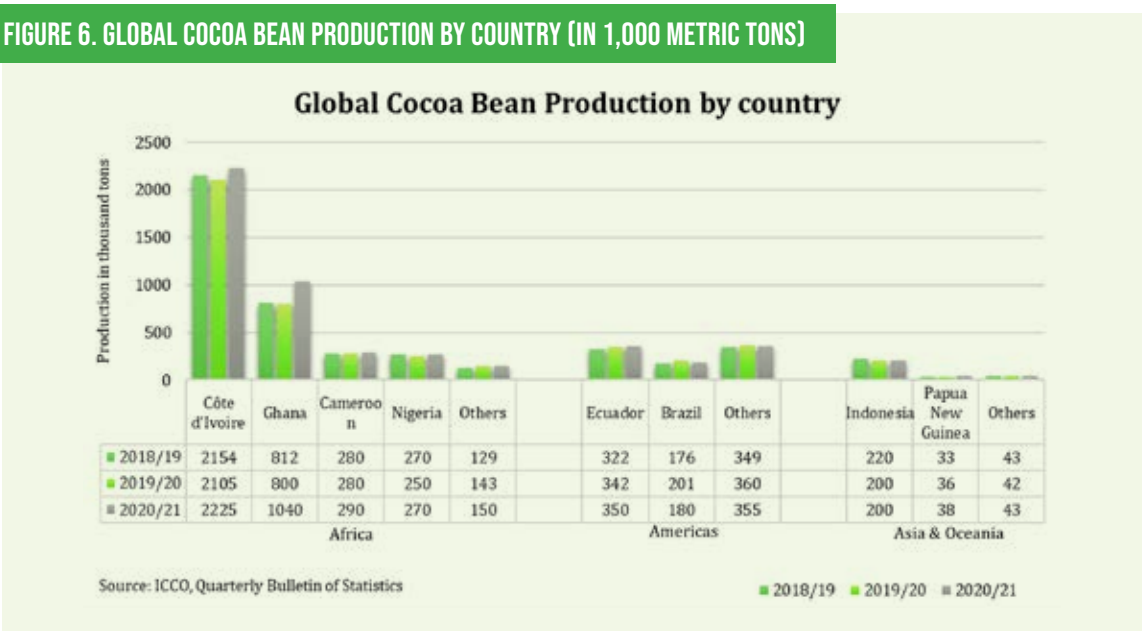
Furthermore, total net disposable continuously takes up majority of the available supply with an average of 81.43% for the same period. Net Food Disposable pertains to the amount of food commodity available in its original or unprocessed form which is intended for human consumption.

Trade (Import and Export)

Cacao is an equatorial plant that grows only within 20 degrees from the equator. Thus, cacao production is commonly seen in tropical regions such as Africa, Latin America, and some parts of Asia. Hence, it is not surprising that the top producing countries of cocoa beans are found in these areas which include Côte d'Ivoire, Ghana, Ecuador, Cameroon, Nigeria, Indonesia, Brazil and Papua New Guinea. According to UNComtrade (2016), the majority of the global production of cocoa comes from only two countries: Cote D'Ivoire and Ghana. The combined supply from these countries constitutes 61% of global exports.

Figure 6 shows the production of cocoa beans by country from 2018/19 and 2019/20, with a forecast for 2020/21. In crop year 2020/21, the top producer is still Côte d'Ivoire with about 2.225 million metric tons (MT) of cocoa beans. All of the top eight (8) cacao-producing nations exhibited increases in the production comparing the 2018/2019 and 2020/21 data, except for Indonesia. Only Indonesia is the Asian country among the said list with 0.200 million metric tons (MT) in 2020/21.

FIGURE 6. GLOBAL COCOA BEAN PRODUCTION BY COUNTRY (IN 1,000 METRIC TONS)



In 2017, the Philippines placed 24th in the cocoa beans production with 7,009 metric tons (MT). This is according to the survey conducted by the Food and Agriculture Organization (FAO). However, the country placed 72nd in terms of exports with a global market share of less than 0.01%.

Table 6 shows the volume and value of exported and imported cocoa products in 2020. Based on volume, the major cocoa product exported by the country in 2020 is still cocoa beans with 5,153 kg (equivalent to USD 13,657). The diversified use of cocoa beans in the manufacturing, pharmaceutical, and cosmetics industries generally pushes the global demand of cocoa beans on an upward trend. Other cocoa products exported by the Philippines include cocoa paste (48 kg), cocoa butter, fat and oil (381 kg), cocoa powder (241 kg), and chocolate and other food preparations containing cocoa (609 kg).

Meanwhile, the largest volume imported is still cocoa powder with 28,389 kg (equivalent to USD 59,511). This is being credited to major chocolate manufacturers in the country that use imported powder and cocoa butter for their raw materials. On the other hand, the biggest importation of cocoa products in terms of value is on Chocolate and other food preparations containing cocoa with USD 82,058 (equivalent to 19,886 kg).

The country also imported cocoa beans (175kg), cocoa shells, husks, skins and other cocoa waste (1841kg), cocoa paste (884kg), and cocoa butter, fat and oil (60kg). The total value of exported cocoa products is USD 22,130 while the imported cocoa products is USD 168,311. Clearly, there is a trade deficit in cocoa, which is equivalent to USD 146,181.

TABLE 5: VOLUME AND VALUE OF EXPORT AND IMPORT OF COCOA PRODUCTS IN THOUSAND METRIC TONS, CY 2020

COCOA PRODUCTS	EXPORT		IMPORT	
	Quantity (kg)	Value (US$)	Quantity (kg)	Value (US$)
Cocoa beans, whole or broken, raw or roasted	5,153	13,657	175	412
Cocoa shells, husks, skins and other cocoa waste	-	-	1,841	348
Cocoa paste, whether or not defatted	48	122	884	3,062
Cocoa butter, fat and oil	381	1,831	60	353
Cocoa powder, not containing added sugar or other sweetening matter	241	659	28,389	59,511
Chocolate and other food preparations containing cocoa	609	2,113	19,886	82,058
Others	1,334	3,749	10,947	22,566
Total	**7,766**	**22,130**	**62,181**	**168,311**

On import trade, countries engaged in cocoa-based products consistently top the world importers of cacao and its preparations. As shown in Table 7, USA has an imported value of almost USD 5,189,358 in 2020 followed by Germany (USD 5,167,840) and the Netherlands (USD 4,801,631). Most of the cacao beans exported by the cacao-producing regions are marketed to grinders in these countries, being the home of giant confectionery companies such as Mars Inc., Mondelez International Inc., and Hershey Foods Corporation, among others.

Other countries in the list include France, United Kingdom, Belgium, Canada, Poland, Italy and Russian Federation. It can be noted that the value of the cocoa imported by the top 10 cocoa-importing countries ranges from 57 to 59% of the total value imported from 2016 to 2020. The growing demand of cocoa beans is positively correlated with the demand for chocolates given that cocoa is the primary raw material that cannot be substituted by other commodities.

TABLE 6: VALUE OF IMPORTS OF THE TOP COCOA-IMPORTING COUNTRIES, 2016-2020

Country/Year	2016	2017	2018	2019	2020
World	47,934,704	47,891,387	49,313,420	49,935,825	49,534,209
United States of America	5,208,799	5,145,881	4,856,588	5,127,504	5,189,358
Germany	5,171,772	5,035,967	5,150,192	5,167,529	5,167,840
Netherlands	4,655,973	4,631,770	4,832,779	4,699,580	4,801,631
France	3,372,693	3,383,133	3,463,365	3,351,070	3,533,514
United Kingdom	2,517,449	2,628,473	2,781,130	2,767,815	2,968,990
Belgium	2,106,722	1,915,644	1,899,152	1,998,365	2,033,189
Canada	1,546,398	1,520,439	1,552,647	1,562,011	1,622,209
Poland	1,133,996	1,224,283	1,324,682	1,330,595	1,531,381
Italy	1,268,153	1,289,793	1,271,023	1,264,366	1,369,448
Russian Federation	971,057	1,048,556	1,179,825	1,248,863	1,221,288

Source: International Trade Center (ITC) Trade Map accessed through http://www.trademap.org

TABLE 7: VALUE OF PHILIPPINE CACAO IMPORTS BY COUNTRY OF ORIGIN (US $), 2016- 2020

Import Market	2016	2017	2018	2019	2020	Total	% Share
Malaysia	35,095	38,151	36,337	45,083	47,865	202,531	20%
Indonesia	31,046	27,544	32,494	32,416	35,442	158,942	16%
United States of America	44,541	37,303	22,796	17,552	14,041	136,233	14%
Switzerland	46,099	25,958	11,884	8,968	2,750	95,659	10%
Singapore	20,247	17,294	17,429	20,268	18,305	93,543	9%

Source: International Trade Center (ITC) Trade Map accessed through http://www.trademap.org

On the other hand, as shown in Table 8, most of the Philippine Cacao Imports are sourced from Malaysia with USD 202,531 from 2016 to 2020 followed by Indonesia with USD 158,942 and USA with USD 136,233. Bigger percentage of importations from Malaysia and Indonesia may be due to the proximity of these countries to the Philippines.

For the 2019/20 forecast, world cocoa grindings are expected to expand to 4.860 million tons, up by 157,000 tons, representing a 3.3% increase compared to the revised estimate of 4.703 million tons. It is anticipated that processing activities will grow by 5.1% to 1.164 million tons in Asia and Oceania, whereas a growth of 7.6% to 961,000 tons is projected for the Americas. In Africa, processing activities are forecast to expand by 0.5% to 1.001 million tons while a 1.6% increase to 1.734 million tons is envisaged in grinding activities for Europe compared to the level attained in the same period of the previous season (ICCO).

The high grinding capacity has already exceeded the bean production, thus, widening the gap of demand and supply. In the Philippines, current production is not even enough to supply local grinding requirements estimated to be at 40,000 metric tons (MT).

Among the primary drivers of this increase are: the big cocoa consumption demand of the United States and Europe, the increasing discretionary household income in developing countries, and the positioning of cocoa as health food, among others.

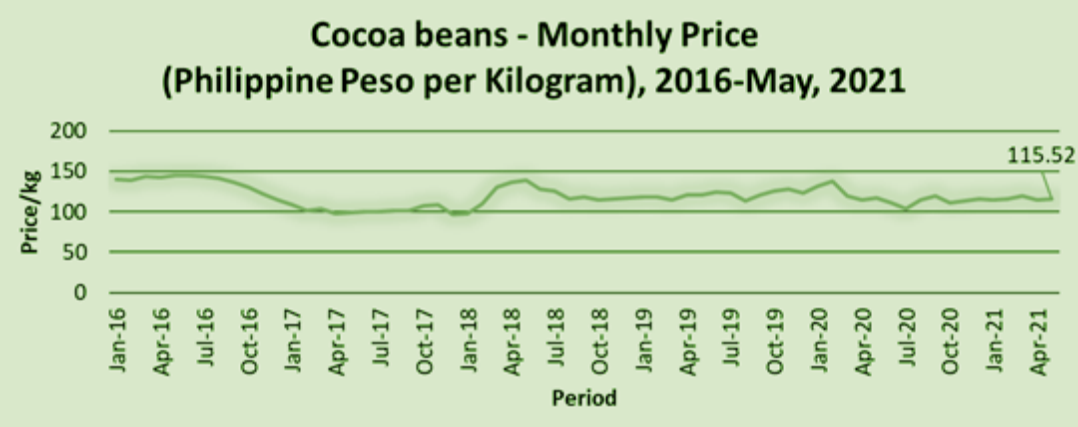
While demand is on an uptrend, supply gap continues to widen due to production constraints brought about by factors such as changing weather condition, pests and diseases, low productivity, aging trees, possible genetic deterioration on commonly used varieties, competing crops and unsustainable cacao farms. The one (1) million metric tons

projected shortfall by 2020 is forecasted by experts to be felt earlier. The scarcity of bean supply also resulted in the closure of grinding facilities.

Prices

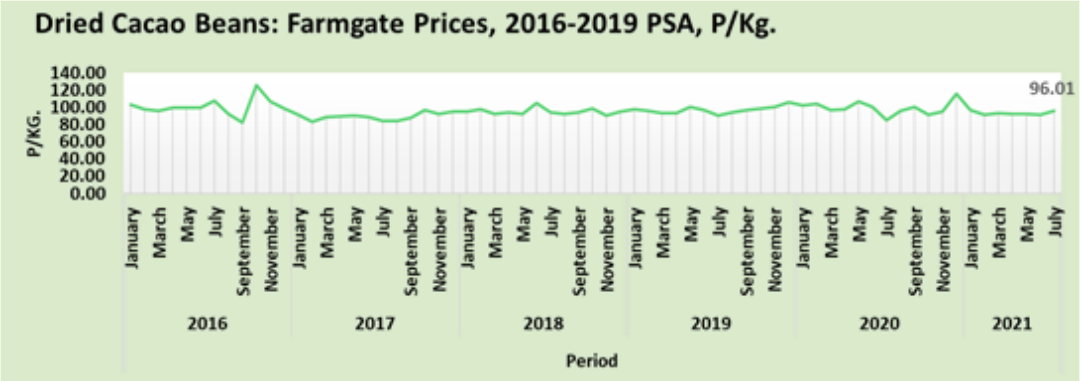
Normally, the local price of the country's cocoa beans is correlated with the international commodities pricing. However, when there is an increased volume in local cacao processing on a certain period (i.e. tablea processors) and the supply of raw materials is nil, it pushes the local price up considering that 'tablea' does not at all times conform to world market prices.

FIGURE 7. WHOLESALE PRICES OF COCOA BEANS FROM JANUARY 2016 TO MAY 2021 (PHILIPPINE PESO PER KILOGRAM)



The wholesale price of cocoa beans in the Philippines ranged from Php 98.00-138.00/kg. As of May 2021, the wholesale price of dried cacao beans is at Php 115.52/kg.

FIGURE 8. FARMGATE PRICES OF CACAO BEANS FROM JANUARY 2016 TO MAY 2021 (PHILIPPINE PESO PER KILOGRAM)



From 2016 to July 2021, the farmgate price of dried cacao beans per month ranged from PhP 82.00 to 126.00/kg. As of July 2021, the farmgate price of dried cacao beans is at P96.01/kg.

Cacao is the only agricultural commodity that defies the law of Supply and Demand. Unlike other commodities, the price of cocoa beans is generally higher during peak season. Low production is between January to April with the price at its lowest. However, during the peak production period, i.e. October up to early January, the price is at its highest. Incidentally, this period is also the peak inventory month for cacao bean for occasions such as Halloween, Christmas and Valentine's Day.

ANALYSIS OF THE CACAO INDUSTRY

Value Chain Analysis

The Value Chain Analysis (VCA) is a concept from business management popularized by Michael Porter in 1985 with the objective of identifying the behavior of costs and the areas for differentiation. It is an approach for breaking down the sequence (chain) of business functions into strategically relevant activities through which value is added by the business. The industry value chain is composed of all the value-adding activities within the industry, beginning with raw materials and ending with the completed product delivered to the customer. In the Philippines, various government agencies complement the Industry Clustering Approach with VCA in order to diagnose industry performance and illustrate the interdependence and relationship among industry players.

As shown in Table 9, there are eight (8) segments in the Cacao industry chain, namely: input provision; cacao farm maintenance and beans production; fermentation, drying, and storage; local trading/marketing; beans processing; exporting; trading of finished products; and final sale in domestic and export markets.

Input Provision

Input suppliers, farmer cooperatives and nursery operators are the sources of raw materials used in cacao production. The most important raw material that these key players provide is the seedling. To provide these seedlings, the following activities are necessary: establishment/expansion and maintenance of budwood gardens/scion groves; propagation and distribution; and nursery accreditation. The destination of these inputs are farmer cooperatives and individual farmers. Moreover, organic fertilizer (such as biofertilizers and biopesticides) and inorganic farm inputs, pod sleeves, packaging materials and other input requirements of the upper level functions are made accessible by the input providers. Most importantly, they provide technical and extension services to producers.

Cacao Farm Maintenance and Beans Production

Producers may be farmer cooperatives or individual farmers. Their activities include planting/replanting/rehabilitation, farm maintenance, nutrient management, water management, pest and disease management and pod harvesting. These activities are necessary to produce cacao pods and wet beans.

Fermentation, Drying and Storage

There are farmer cooperatives which may be involved in processing activities. These cooperatives eventually coordinate with local processors, which sell to the local market and exporters, for the sale of their produce to the export market. Farmer cooperatives together with wet beans buyers are tasked to do the following activities to produce either dried or fermented beans and dried beans: pod breaking; fermentation; drying; packaging; storage; utilization of cacao waste and by-products; and other value-adding activities.

Local Marketing/Trading

In local marketing/trading of dried and fermented beans, farmer cooperatives and traders organize activities related to consolidation, cleaning, packaging and labelling, hauling, transporting, wholesaling, and retailing.

Beans Processing

Beans are further processed by farmer cooperatives and processors into nibs, tablea, butter and powder (set A) or chocolates and chocolate products (set B). For the first set of products, the tasks to be undertaken include cleaning, roasting, winnowing, grinding, pressing, pulverizing, packaging and storage. For chocolates and chocolate products, the activities are cleaning, roasting, winnowing, grinding, mixing/refining, conching, moulding and packaging.

Exporting

Products are then transported/shipped by exporters and processors to traders and other exporters. These products include tablea, cocoa beans, cocoa butter, cocoa powder, chocolates, and cocoa paste.

Trading of Finished Products and Final Sale in Domestic and Export Markets

The above-mentioned products are sold in retail by traders and exporters in the local and export markets. Supermarkets and retailers undertake the selling function. Final consumers include local households and consumers, OFWs, and tourists.

TABLE 8: CACAO INDUSTRY VALUE CHAIN MAP

Functions	Input Provision	Cacao Farm Maintenance and Beans Production	Fermentation, Drying and Storage	Local Marketing/Trading	Beans Processing	Exporting	Trading of Finished Products	Final sale in Domestic and Export Markets
Tasks/roles	• Provision of seedlings: a. establishemnt/ expansion, maintenance of budwood gardens/ scion groves b. propagation and distribution c. nursery accreditation • Make accessible fertilizer, pesticide, pod sleeves • Make accessible design and packaging materials and other input requirements of the upper level functions • Technical, extension services	• Planting/ replanting/ rehabilitation • Farm maintenance • Nutrient management • Water management • Pest and disease management • Pod harvesting	• Pod breaking • Fermentation • Drying • Packaging • Storage • Utilization of cacao waste and by-products • Other value-adding activities	• Consolidation • Cleaning • Packaging & labeling • Hauling • Transporting • Wholesaling • Retailing	Set A • Cleaning • Roasting • Winnowing • Grinding • Pressing • Pulverizing • Packaging • Storage Set B • Cleaning • Roasting • Winnowing • Grindling • Mixing/ Refining • Conching • Moulding • Packaging	• Transporting/Shipping	• Retailing	• Buying

Functions	Input Provision	Cacao Farm Maintenance and Beans Production	Fermentation, Drying and Storage	Local Marketing/Trading	Beans Processing	Exporting	Trading of Finished Products	Final sale in Domestic and Export Markets
Role players/ Operators	Input Suppliers Farmer Cooperatives Nursery Operators	Farmer Cooperatives Individual Farmers	Wet beans buyers Farmer Coops	Farmer Cooperatives Local Traders	Farmer Cooperatives Processors	Exporters Processors	Traders Exporters	Consumption
Product	- Seedlings - Organic ferilizers Technical services	Cacao pods, wet beans	Dried beans, fermented and dried beans	Dried beans, fermented and driend beans	Set A: Nibs, Tableam Butter, Powder Set B: chocolates and chocolate products	Tablea, Cocoa Benas, Cocoa Butter, Cocoa Powder, Chocolates, Cocoa paste	Tablea, Cocoa Beans, Cocoa Butter, Cocoa Powder, Chocolates, Cocoa paste	Local Households and Consumers, OFWs, Tourists, Supermarkets, Retailers, Export Market
Enablers	DA, DA-HVCDP, DA-BPI, DA-ATI, DA-BAFS, DA-BSWM, DA-BAR, PCA, DAR, DENR, DTI, DOST, PCIC/PCIA, LGUs, MinDA, Academe, Government, other private sector group, ACPC, LBP and other Funding Institutions			DA, DA-HVCDP, DA-AMAS, DTI, PCIC/PCIA LGUs	DA, DA-HVCDP, ATI, TESDA, PhilMech, DTI, DOST, PCIC/PCIA, LGUs	DA, DTI, PCIC/PCIA, Attaches ---	DA, DTI, PCIC/PCIA	Tablea, Cocoa Beans, Cocoa Butter, Cocoa Powder, Chocolates, Cocoa paste

As shown in Table 9, the cacao industry is packed with industry enablers from the government sector, private sector, and non-government organizations. These enablers provide support services in the form of technical and financial interventions including the provision of postharvest facilities and support infrastructures as indicated in their respective mandates. These generally enable the development and strengthening of the industry.

One of the players that has a major role in the realization of the different interventions is the strengthened Philippine Cacao Industry Council (PCIC). The PCIC was created to spearhead the development of the industry. It is a private sector led council composed of public and private sector representatives. To provide co-leadership, the Department of Agriculture acts as a co-chair. Furthermore, at the Regional level, the Regional Cacao Industry Councils were established. These councils spearhead the development of the industry in their respective regions. The elected chairpersons represent their regions at the Philippine National Cacao Industry Council (Philippine Cacao). To date, sixteen (16) regional councils and five (5) provincial councils have already been created.

Enablers

The potential and significant contributions of the cacao industry to employment and income generation have led the various government agencies to initiate interventions that will support the development of the industry. Among the programs designed to provide support are as follows:

- High Value Crops Development Program of the Department of Agriculture (DA);
- Philippine Rural Development Program of DA;
- National Greening Program of the Department of Environment and Natural Resources;
- Coconut-Cacao Enterprise Development Project of Philippine Coconut Authority;
- Industry Clustering, Market Assistance, Trade Promotion and Shared Service Facility Programs of the Department of Trade and Industry (DTI);
- Market Resurgence Program (MRP) of DTI;
- Agrarian Production Credit Program of the Department of Agrarian Reform;

- Mindanao Sustainable Agrarian and Agriculture Development (MinSAAD) Project;
- Credit Program of the DA-Agricultural Credit Policy Council;
- SETUP, MPEX, and CAPE, NICER, RDLead, CRADLE and BIST Programs of DOST; and
- Research and Development Projects of the DA-Bureau of Plant Industry and academe.

The convergence of government support programs and projects touches various levels of the cacao industry value chain and is expected to transform and empower cacao farmers into thriving cocoa communities, which are the essential foundation for sustainable cocoa farming. To reach this goal of transformation and empowerment, there is a need for collaborative and harmonized interventions among government agencies, private and non-government organizations.

Infrastructure Support and Logistics

Postharvest Facilities

Availability of efficient postharvest facility in every region is necessary to produce quality cocoa. In line with the goal in positioning the Philippines as producer and exporter of Fine Flavour Beans, postharvest facilities for fermentation and drying need to be provided.

At present, majority of the cacao farmers ferment and dry the cacao beans at their farms or homes using makeshift equipment. Cacao beans are dried on the ground or makeshift platforms, which may expose the beans to surface contamination and infestation. The absence of appropriate solar dryers or mechanical dryers slows down the drying of cocoa beans during rainy season, allowing moulds to develop. On the other hand, rapid drying prevents the oxidation of acetic acid, which leads to excess acid trapped within the beans. Hence, this lack of appropriate machinery may cause serious problems for the industry as it affects the flavor and quality of the beans.

To attain these quality requirements, appropriate postharvest facilities must be available in all cacao-growing communities. These facilities include cacao bean grading kits, fermentary facility, solar dryer with UV cover, mechanical dryer, multipurpose dryer pavement, and warehouse.

Nursery and Budwood Garden

Given the competitive advantage and marketing potentials of cacao in the local and world market, many farmers have ventured in the industry in the recent years. However, the supply of quality planting materials was not enough to meet the demand of the increasing number of cacao growers as nursery and budwood gardens are limited.

There are over 150 nursery operators in Davao Region with combined production of more than five (5) million seedlings per year. These nursery operators are supplying the Davao Region and Mindanao areas as well as Luzon and Visayas areas. Ready to sow seeds and bud sticks, which are the primary inputs to nursery operation, are also sourced out from Davao. However, high mortality on planting materials was observed due to improper handling and transport.

The existing supply gap and the proliferation of non-accredited nurseries are major concerns that hamper the expansion and development of the industry. Hence, ensuring easy access and availability of quality planting materials should be given top priority. In order to address these concerns, there is a need to establish additional nurseries and budwood gardens at the provincial level. In addition, plant nursery accreditation and certification in the province should be strengthened at the same time more nurseries in the municipalities be accredited.

Farm-to-Market Road

Accessibility to farm-to-market road (FMR) plays a vital role in the production and marketing aspects of the industry.

In the production side, the lack of FMR affects the farmers' capacity to transport farm inputs and farm products, thus increasing their production costs. The delay of movement in the harvested cacao to postharvest facilities and/or marketing channels also affects the quality of beans, thus resulting in low farm gate prices.

As for the marketing aspect, poor road networks limit the farmers' opportunities to gain access to larger commercial channels and to choose buyers who can provide higher prices. Oftentimes, farmers rely on middlemen who often buy their beans at a much lower price.

Since most cacao farms are located in the rural areas, issues on product consolidation, delays in the movements of crops, farm inputs, and finished product, which affect production costs and farm gate prices, are very evident.

To help farmers gain better leverage on market and have better access to inputs, it is recommended that Farm-to-Market Road (FMR) initiatives put priority on the locations where cacao growing is suitable as presented in Appendices 2 and 3: Climate and Soil Suitability map.

Research for Development

Improvement and innovation across the different areas of the value chain (input provision to production and processing) are necessary in gaining competitive and comparative advantage. Accordingly, both the private and public sectors including the academe have been independently doing research and development on cacao production and management as well as product development and enhancement in order to attain its competitive advantage.

On cacao production and management, the agriculture-based academic institution such as the University of Southern Mindanao (USM) undertakes various researches that aim to develop new generation of superior clones that are high-yielding, high fat content, and resistant to Cocoa Pod Borer (CPB), Phytophthora pod rot, and Vascular Streak Dieback (VSD). Together with the DA-BPI, new cacao hybrids were developed, and studies on varietal appropriateness to local conditions were made.

To complement the research and development (R&D), the University of the Philippines Los Baños (UPLB), DA-BPI and the DOST in partnership with the private sector undertook research and development interventions to develop new technologies in nursery operation, farm production protocols and postharvest processing. These initiatives aim to increase farm efficiency and productivity as well as enhance product quality.

Although product development and enhancement are commonly initiated by the private sector engaged in processing/manufacturing, the government sector such as the DOST is also conducting researches for quality improvement of various cocoa-based products such as tablea, liquor, etc.

While there have been a number of researches conducted, the stakeholders believe that continual research and development across the value chain is necessary. However, research results should not be confined in R&D centers, therefore better and wider dissemination of research findings and transfer of technologies should also be prioritized. The establishment of a Cacao Research Center is being pushed by the industry players in order to have a focal center for R&D and depository of all cacao researches.

Human Resource Development

At present, the private sector and non-government organizations such as the Kennemer Foods International (KFI), CSI Trade Ventures., Cacao Industry Development Association of Mindanao (CIDAMI), and ACDI/VOCA provide technical support to cacao farmers across the country. Likewise, public sector initiatives led by DA, DAR, DENR, and DTI in partnership with Cacao Industry Development Association of Mindanao Inc. (CIDAMI) provide human resource trainings not only in the field of production but also on entrepreneurship.

It is evident that the importance of capacity building has been recognized and given priority by all sectors. However, most of the training centers are located in Region XI, thus making it less accessible to other regions such as Luzon and Visayas. To address this gap, PCIC in collaboration with TESDA will design and conduct trainings nationwide. Alongside with this initiative is the preparation of the Harmonized Cacao Production and Postharvest Protocols that will be published and made in digital format to reach more cacao growers.

Credit Support & Insurance

Credit is essential in the modernization and transformation of the country's cacao industry into a dynamic, high-growth sector. Access to timely and affordable credit is crucial to eliminate the cacao farmers' financial constraints to invest in farm activities, improve technologies, and increase productivity. The government has been implementing agricultural credit programs that cacao farmers and cacao-based micro and small enterprises (MSEs) and other players in the cacao value chain can access to finance the

capital requirements of their production, processing, marketing as well as farm rehabilitation and/or expansion undertaking, and other activities along the cacao value chain.

The Department of Agriculture (DA) including its attached agencies and the Department of Agrarian Reform are the government agencies responsible for the majority of the lending programs for the agricultural sector. The government credit programs administered by DA, DAR and other related agencies are designed to provide preferential (subsidized) loans to smallholder farmers, including those in cacao farming.

Majority of DA and DAR credit programs are implemented in partnership with the Land Bank of the Philippines (LBP). A number of the DA programs are also in partnership with cooperatives, farmers' associations and rural banks in delivering credit to smallholder farmers. Loans are granted for the purpose of purchasing inputs, as working capital, and/or for the acquisition of farm equipment, machineries and post-harvest facilities. DA and DAR also make available financing support for immediate relief and recovery of small farmers affected by calamities and other disastrous and fortuitous events.

Cacao farmers and cacao-based MSEs may also avail financing through the lending windows provided by government-owned financing institutions such as the Land Bank of the Philippines (LBP) and the Small Business Corporation (SBC).

Shown below is the list of these programs.

TABLE 9. AGRICULTURAL CREDIT PROGRAMS

Agency	Program Name	Description
DA	Agricultural Competitive Enhancement Fund (ACEF)	Designed to increase productivity of farmers and fishers by providing credit for the purchase of farm inputs, machineries, equipment, and establishment and improvements of production and post-harvest facilities.
DA	Agrarian Production Credit Program (APCP)	Provides agri-production and enterprise credit, capacity building, and other support services to agrarian reform beneficiaries and their organizations.

Agency	Program Name	Description
ACPC	AgriNegosyo Program (ANYO) and its subprograms	Provides accessible and affordable credit to eligible borrowers to finance income-generating activities (production, processing, or marketing or agri-fishery income generating activity and non-farm micro-enterprise) and working capital and/or fixed asset acquisition (agricultural facilities construction/acquisition, machinery/ equipment acquisition) requirements of the micro and small agribusiness enterprise and farmers and fisherfolk cooperatives/ associations
ACPC	Kapital Access for Young Agripreneurs (KAYA)	Finance working capital and/or fixed asset acquisition requirement of start-up or existing agri-based projects of young entrepreneurs and agri-fishery graduates.
ACPC	Survival and Recovery Loan Assistance (SURE) Program	Provides immediate financing relief to small farmers and fishers affected by natural and other calamities, animal disease outbreak, and other disastrous events.
DAR	Expanded Assistance to Restore and Install Sustainable Enterprise for Agrarian Reform Beneficiaries and Small Farm Holders (E-ARISE-ARBs)	Financing support for disaster affected ARBOs and small farmer holders and their families to restore livelihoods and farming activities.
DAR	Credit Assistance Program for Program Beneficiaries Development (CAP-PBD)	Provides credit assistance to existing CAP-PBP Window III cooperative/farmers association borrowers to ensure their sustained economic development.
LBP	Credit Assistance for Cacao Agribusiness Entities and Other Organizations 100 (Cacao 100)	Finance cacao industry stakeholders and help them attain their mission of producing 100,000 metric tons of dried fermented beans by 2022
SBC	MSME Financing Programs	Direct lending to registered micro, small and medium enterprises (MSMEs), which aims to bridge the financing gap of "pre-bankable but viable" MSMEs that are at the moment "unserved" by the banking system. Through this program, MSMEs are provided with a conducive environment by financing their business needs, training them to get credit track record and experience, and building up business size necessary to access bank financing in the future.

Source: ACPC, DAR, LBP, DTI

While there are government-initiated interventions, it is imperative to increase the participation of the private sector in the provision of financing services to cacao farmers, in particular to the smallholders who lack capitalization, to advance their production activities and enable them to viably and sustainably contribute to the economy. Enhancing the enabling policy and regulatory environment is crucial to allow (1) adoption of market-based financial and credit policies, (2) focus on proper management and utilization of loan fund, (3) engagement and active participation of banks and government financial institutions, and (4) provision of critical support services in order to serve and provide accessible financing to more farmers including those engaged in cacao farming and cacao-based enterprises. Moreover, current programs only fund new farms that are operating for 0 to 3 years. Cacao growers with farms that need rehabilitation are having difficulty in raising funds for their farm activities.

In terms of insurance, the Philippine Crop Insurance Corporation (PCIC) has been offering insurance coverage to both commercial and non-commercial cacao growers/farmers under its tree and seedling mortality insurance products. These insurance products serve as a form of protection against losses due to natural calamities and pest and diseases infestation. The PCIC also provides free subsidized insurance coverage to subsistence cacao farmers that are listed in the Registry System for Basic Sector in Agriculture (RSBSA). Cacao farmers who are not in the list may go to their respective Municipal or Provincial Agriculturist to register and be included in the said list. Additionally, Crop Insurance may be bundled with certain agricultural credit programs, such as those offered by ACPC. These agricultural credit programs are in a form of loan and income security programs that are extended to the farmers.

SWOT Analysis

The series of consultative meetings and national convergence allowed the stakeholders to discuss strengths, weaknesses, opportunities and threats that are prevalent in the industry. These are as follows:

TABLE 10. SWOT ANALYSIS OF THE PHILIPPINE CACAO INDUSTRY

Value Chain Activities	Strengths	Weaknesses	Opportunities	Threats
Final sale in the Domestic and Export Markets Trading of Finished Products Exporting Beans Processing Local Marketing/Trading	• Accessibility to domestic and foreign trade • Global recognition of Philippine cacao beans and products • Six (6) cacao products sold to local and international markets • No product substitutes • Presence of players from all stages of the value chain • Cacao prices defies the law of supply and demand • Convergence of government support programs and projects • Continuous R&D • Presence of enablers from the government sector, private sector and NGOs • Strengthened Philippine Cacao Industry Council, regional and provincial councils	• Limited number of processors (Common Service Facilities) • Underutilization of the capacity of local grinders • Insufficient/inappropriate/ Lack of knowledge on the use of PH facilities • Lack of Philippine Cacao Brand • Inefficient Market Linkages • Trade-deficit in cacao • Weak technology commercialization	• Increasing discretionary household income in developing countries • New and innovative uses of cocoa in the food, cosmetics and pharmaceutical industries • Increasing awareness of consumers to fair trade and health & wellness • Positioning of cacao as health food • Growing number of restaurants and coffee shops serving cocoa-based drinks and food items • Growing industry of medium and small-scale chocolatiers requiring high quality cocoa beans • Increasing purchasing power of middle-aged working class	• Decreasing world market price • Setback from pandemic
Fermentation, Drying and Storage				

Value Chain Activities	Strengths	Weaknesses	Opportunities	Threats
Cacao Farm Maintenance and Beans Production	• Suitability of location for production • Suitability of cacao as intercrop • Early gestation period • Two-week harvest interval • Early Return on Investment and high profitability	• Low productivity level • Unstable yield from 2020-2014 despite area expansion • Aging cacao trees in major production areas • Dominance of small-scale production • Inadequate R&D Centers • Inaccessibility to credit	2M hectares of coconut farms ideal for cacao cropping	• Occurrence of pests and diseases • Wild weather pattern • Competition with other plantation crops • Possible genetic deterioration on commonly used varieties
Input provision	• Massive distribution and cultivation of planting materials • On-going crafting of harmonized production and postharvest protocols	• Non-self-pollinating characteristic of cacao • Inefficient procurement and distribution system of planting materials • Proliferation of non-accredited nurseries		

Cost and Return Analysis

Production

Consistent with the bright market opportunities of the industry is the promising return on investments (ROI) for those who are or will be engaged in cacao production. As illustrated in the table below, production cost of planting cacao (monocrop or intercrop) is relatively low. For monocrop production, initial production cost for the first year is at PhP89,628.00 per hectare (equivalent to 1,100 cacao trees) while intercrop planting is estimated to be at PhP61,148.00 per hectare (equivalent to 600 cacao trees).

Based on the data provided, material cost for cacao production is higher than the labor cost in intercrop planting from the first year until the third year of production. Material costs during these years comprise 65 to 75% of the total production, which went to the investment on seedlings, tools and other inputs. On the other hand, for monocrop production, material cost is higher than the labor cost during the first year of production only. This is due to the maintenance cost per year after the first year of production, which is equivalent to Php60,000.

Furthermore, production cost can even be lower when low-cost organic farm inputs such as biofertilizers and biopesticides are utilized. Biofertilizers like MYKOVAM is applied once only throughout the life time of the crop. It is composed of mycorrhizal fungi that proliferate in the roots and rhizosphere and aids in the absorption of more nutrients and water especially in marginal areas exposed to drought and high temperature. Only a very minimal amount of chemical fertilizer (from 25 to 50% of the recommended rate) is needed during the early establishment period of the field planted seedling.

Unlike other crops, ROI of cacao production can be gained within three (3) years both for monocrop and intercrop areas since harvest may be done within 18 months for well-managed farms. Profitability is higher on the third year as net income doubles relative with the production cost.

The promising income that the industry can offer accompanied with the numerous employment (being a labour-intensive industry) it can generate through cacao production will ultimately help in the government's goal for countryside development and poverty alleviation.

TABLE 11: COSTS AND RETURNS PER HECTARE AS INTERCROP (600 TREES PER HECTARE)

PARTICULARS	YEAR 1	YEAR 2	YEAR 3	YEAR 4	YEAR 5
Yield					
Trees per Hectare	600	600	600	600	600
Pods per Tree		7	34	59	70
Total Pods per Hectare		4,200	20,400	35,400	42,000
Pod Index	20	20	20	20	20
Wet beans (kg/ha)		630	3,060	5,280	6,300
A. MATERIALS					
Tools					
Knapsack sprayer for insecticides	2,500				
Hand tools: spade, bolo, pruners, others	2,000				
Sub-total (PhP)	4,500				
Seedlings					
Total seedlings needed (Add: 10% for replacements of mortalities)	660				
Cost per seedling	20				
Sub-total (PhP)	13,200				
Dolomite (for soil pH correction)					
No. of kilos applied	1,000			1,000	
No. of bags required	20			20	
Cost per bag	180			180	
Sub-total (PhP)	3,600			3,600	
Fertilizer: 16-16-16					
Application rate (grams per tree)	340	560	600	600	600
Total kilos	240	336	360	360	360
Cost per bag	1,510	1,510	1,510	1,510	1,510
PARTICULARS	YEAR 1	YEAR 2	YEAR 3	YEAR 4	YEAR 5
Cost per kilo	30	30	30	30	30
Sub-total (PhP)	7,248	10,080	10,800	10,800	10,800
Fertilizer: Organics					
Application rate (kilos per tree)	3		3		3
Total kilos	1,800		1,800		1,800
Cost per kilo	7.50		7.50		7.50

PARTICULARS	YEAR 1	YEAR 2	YEAR 3	YEAR 4	YEAR 5
Sub-total (PhP)	13,500		13,500		13,500
Agri. chemicals (foliar; fungicide; insecticide)					
No. of application cycles	24	24	24	24	24
Cost/knapsack	29	29	29	29	29
No. of Knapsack	1.50	3	4	5	6
Sub-total (PhP)	1,100	2,088	2,784	3,480	4,176
Herbicide Spray					
No. of application cycles	4	4	3	2	1
Cost/knapsack	41	41	41	41	41
No. of Knapsack	12	12	12	12	12
Sub-total (PhP)	2,000	2,000	1,500	1,000	500
Plastic sleeves for CPB control					
Total sleeves needed		4,200	20,400	35,400	42,000
Cost per piece		0.06	0.06	0.06	0.06
Sub-total (PhP)		252	1,224	2,124	2,520
Provision for harvest sacks for pods		525	2,550	4,425	5,250
TOTAL MATERIALS COSTS (PhP)	45,148	14,945	32,358	25,429	36,746
B. LABOR					
Clearing					
Cost per man day	200				
No. of man days	5				
Sub-total (PhP)	1,000				
Layout / staking					
Cost per man day	200				
No. of man days	4				
Sub-total (PhP)	800				
Digging of holes					
Piece rate	5				
No. of holes	600				
Sub-total (PhP)	3,000				
Planting					
Cost per man day	200				

PARTICULARS	YEAR 1	YEAR 2	YEAR 3	YEAR 4	YEAR 5
No. of man days	12				
Sub-total (PhP)	2,400				
Round weeding & mulching					
Piece rate	2	2			
Total per cycle	1,200	1,200			
Number of cycles	4	4			
Sub-total (PhP)	4,800	4,800			
Foliar Spray					
Cost per man day	200	200	200	200	200
No. of knapsack	1.50	3	4	5	6
No. of man days	25	50	62.50	75	87.50
Number of cycles	24	24	24	24	24
Sub-total (PhP)	600	1,200	1,500	1,800	2,100
Herbicide Spray					
No. of application cycles	4	4	3	2	1
PARTICULARS	YEAR 1	YEAR 2	YEAR 3	YEAR 4	YEAR 5
No. of Knapsack	12	12	12	12	12
Sub-total (PhP)	800	800	600	400	800
Dolomite application/liming for soil pH Correction					
Cost per man day	200			200	
No. of kilos applied	1,000			1,000	
Application efficiency (i.e., kilos/man day)	150			150	
No. of man days required	1			1	
Sub-total (PhP)	200			200	
Fertilizer application					
Cost per man day	200	200	200	200	200
Total man days	2	2	2	2	2
No. of application cycles	4	4	2	2	2
Sub-total (PhP)	1,600	1,600	800	800	800
Tree pruning, chupon pruning, shaping					
Cost per man day	200	200	200	200	200
Total man days	1	4	3	3	3

PARTICULARS	YEAR 1	YEAR 2	YEAR 3	YEAR 4	YEAR 5
No. of cycles	4	3	3	2	2
Sub-total (PhP)	800	2,400	1,800	1,200	1,200
Pod sleeving					
No. of pods for sleeving	-	4,200	20,400	35,400	42,000
Piece rate	0.10	0.10	0.10	0.10	0.10
Sub-total (PhP)	-	420	2,040	3,540	4,200
Harvesting, pod breaking					
Kilos of wet beans harvested	-	630	3,060	5,280	6,300
Labor cost per kilo of wet bean harvested	3.50	3.50	3.50	3.50	3.50
Sub-total (PhP)	-	2,020	10,710	18,400	22,050
PARTICULARS	YEAR 1	YEAR 2	YEAR 3	YEAR 4	YEAR 5
TOTAL LABOR COSTS (PhP)	16,000	13,240	17,450	26,340	31,150
C. TOTAL MATERIALS AND LABOR COSTS (PhP)	**61,148**	**28,185**	**49,808**	**51,769**	**67,896**
REVENUES					
Wet beans (kg/ha)	-	630	3,060	5,280	6,300
Gross Value Wet beans (at PhP28/kg)		10,080	85,680	147,840	176,400
D. NET INCOME	**-**	**(18,105)**	**35,872**	**96,071**	**108,504**
E. RETURN OF INVESTMENT (%)		**(64.24)**	**72.02**	**185.58**	**159.81**

**600 trees per hectare (with 10% for replacement of mortalities)
**50 kg per bag of Dolomite and Inorganic fertilizer

TABLE 12: COSTS AND RETURNS PER HECTARE AS MONOCROP (1,100 CACAO TREES PER HECTARE)

PARTICULARS	YEAR 1	YEAR 2	YEAR 3	YEAR 4	YEAR 5
1. Cacao seedlings (1,100 pcs. @ PhP 25/seedling	27,500				
4. Fertilization at Planting (PhP 1300/ bag) - Inorganic at 50 grams/hill - Organic Fertilizer at 200 grams/hill (P300/bag)	2,750				

PARTICULARS	YEAR 1	YEAR 2	YEAR 3	YEAR 4	YEAR 5
5. Maintenance Fertilization (PhP 1300/ Bag of 50 kg) - Vegetative Stage at 100-150g/ application/tree - Productive Stage at 200-250g/ application/tree	8,580	17,160	22,800	28,599	28,600
4. Pesticides, Application as needed	1,850	2,775	3,700	3,700	3,700
5. Hand tools and Equipment	3,000	1,000	1,000	1,000	1,000
6. Sacks and Crates		1,000	2,000	3,000	3,000
7. Establishment Cost: (Labor Piece Rate PhP 350)					
Land Prep (Clearing, staking, liming)	8,000				
Holing & Planting at P15.00 X 1,100 holes	16,500				
Weeding Quarterly 12 MD	4,200				
Pruning quarterly at 10 MD	3,500				
Fertilizer application, quarterly at 4 MD	1,400				
Chemical Spraying, 12MD	4,200				
8. Farm Maintenance: PhP 10,000/ Month for 2 Ha		60,000	60,000	60,000	60,000
9. Pod Breaking at PhP 1.50/kg		1,350	4,500	6,750	9,000
TOTAL EXPENSES	**81,480**	**83,285**	**94,000**	**103,050**	**105,300**
10% Contingency	89,628	91,613	103,400	113,355	115,830
TOTAL PRODUCTION COST					
Yield at 90% productive trees or say 1000 trees productive. 100% good beans		**15%**	**50%**	**75%**	**100%**
Total Dried Bean Production at 2kg/Tree		300	1,000	1,500	2,000
Gross Value (Price index PhP 110/kg)		33,000	110,000	165,000	220,000
Net Income for Productivity Level of 2kg DFCB	**(89,628)**	**(58,613)**	**(6,600)**	**65,065**	**112,090**
Total Dried Bean Production at 3 kg/ Tree		450	1,500	2,250	3,000
Gross Value (Price Index PhP 110/kg)		49,500	165,000	247,500	330,000
Net Income for Productivity Level of 3kg DFCB	**(89,628)**	**(42,113)**	**61,600**	**134,210**	**214,170**

PARTICULARS	YEAR 1	YEAR 2	YEAR 3	YEAR 4	YEAR 5
Total Dried Bean Production at 4 kg/ Tree		600	2,000	3,000	4,000
Gross Value (Price Index PhP 110/kg)		66,000	220,000	330,000	440,000
Net Income for Productivity Level of 4kg DFCB	**(89,628)**	**(25,613)**	**116,600**	**216,645**	**324,170**

Key to Higher Income: Higher Productivity. At least 3 kg/tree/year
Percentage of Productive Tree should be not less than 90%
Beans rejection/damage beans should not be more than 10%
Field Operation Efficiency, Good alignment & Branching at 1 meter
High Planting Density; Go for 1,450 trees per hectares
Proper fruit care.
High percentage of good pods and good beans
Convert fixed cost to variable cost

Value-added products

In the Philippines, there are seven cacao products sold to local and international markets. These are the wet beans, dried beans, dried fermented beans, cacao nibs, tablea, cocoa powder, and cocoa butter. Value of each product generally depends on the value-added inputs and demand in the market.

Products that have undergone value-adding processes are more valued. Per industry estimate, the value of beans increases four times when converted to tablea and increases eight times when converted to chocolate. This entails that in order to gain higher profitability, producers must value-add their products instead of settling into wet or dried beans alone.

In the previous roadmap, it was mentioned that among the most valued cacao product is the cocoa butter which is being sold at PhP750.00 per kilogram or higher. This product is a pale-yellow, edible fat extracted from the cocoa beans. It accounts 45-57% of the bean content and is the most expensive. It is a major ingredient in practically all types of chocolates and also being used in making ointments, toiletries, and pharmaceuticals.

In selling beans, the dried fermented ones are more valued compared to the wet and dried beans. Farmers may have an additional PhP10-15.00 per kilogram in selling dried fermented beans. However, in order to market this type of product, availability and accessibility to postharvest facilities are very important to farmers.

In terms of tablea product, the farmers get the highest profitability with 38% or equivalent to PhP130.00 based on the PhP 215.00 selling price of 1.5 kg of beans. Production cost is estimated at PhP45.00 - PhP50.00 per kilo of dried fermented beans. The minimal requirement for additional inputs and overhead costs, and the prevailing market price based on supply and demand, contribute to the bigger profitability of the farmers. On the other hand, tablea processors gain the next highest profit as compared to other levels of the value chain. A twenty-nine percent profit, equivalent to PhP99.00 per kilogram, is gained by the processors out of the PhP450.00 selling price per kilogram. Traders and wholesalers/retailers only acquire 4% and 14% profitability shares, respectively.

Under the value chain distribution in the international scenario, 6.6% profit goes to the farmer for every bar of chocolate, while the chocolate producer and retailer take 35% and 44% of the shares, respectively.

Farmers with value-adding activities gained more economically. Thus, the cocoa sector can contribute much in terms of inclusive economic growth. This is very important in spurring up rural economic development. This is on top of the jobs created and other related livelihood opportunities that can be created.

Benchmark Analysis

Majority of the cacao farms in the country are small holdings and are being owned and managed by farmers. These farmers are generally undergraduates who have gained knowledge in farming from their descendants or from experience. Consequently, majority of them have limited technical skills and knowledge on production, marketing, and entrepreneurship. Further, farmers have limited access to relevant and updated data, information, and technologies that they can use.

This human resource gap often becomes a hindrance in attaining the desired productivity and competitiveness of the industry. For instance, the lack of knowledge on Good Agricultural Practices (GAP) led to improper farm management resulting in low yield and vulnerability of cacao plant to pest and diseases. Likewise, the lack of knowledge on postharvest processing and the use of postharvest facilities also affects the quality of the cocoa beans. These inadequate skills and knowledge have greatly impacted the farmers' ability to maximize income potential from cacao growing. Addressing these gaps are relevant to the industry given that cacao production is labour-intensive rather than capital-intensive.

The table below shows the assessment of farmers on the effect of their current practices on income and the environment as well as their proposed solutions. This was adopted from the Value Chain Analysis and Competitive Strategy: Davao Del Norte Cocoa Bean.

TABLE 13: FARMERS' ASSESSMENT OF THE EFFECT OF THE CURRENT PRACTICES ON INCOME AND ENVIRONMENT WITH PROPOSED SOLUTIONS AND INTERVENTION APPROACH

Common Practices	Impact on Environment (IE)	Impact on Business (IB)	Solution	Intervention Approach
Use of pesticides (Fungicide/ Herbicide) Decis, Dithane, Malathione, Alliete, Ader Round-up, Power Teeweed, Clear-up	Death of pollinator: tag-nok, bees, bat, butterfly Air contamination Health hazardous	Low production High cost of production	Practice integrated pest management Transition to organic farming practices	Encourage farmers group to supply organic pesticides & organic fertilizers Conduct training on organic farming Regular monitoring of organic farming practices
Fertilizer/ synthetic Urea, complete, ammonium sulphate, potash, Viking	high phosphate/ nitrate acidic soil water contamination	High cost of production, low profit not sustainable		
Disposal of cacao pods -use as substrate of vermiculture -non-utilization of cacao pods scattered in the area	Recycling - organic fertilizer Spread of fungus infestation in the area; more mosquitoes - dengue	Low production cost Loss of income	Conversion of cacao pods to compost	Acquisition of pod shredder Training on equipment maintenance
Transportation to procure inputs	Use of energy Carbon emission	Additional Cost	On-site nursery establishment	Capacity building

Moreover, the characteristics of cocoa produced depends on the genotype, soil, climate and harvest conditions, and postharvest activities, particularly fermentation, drying and roasting. Fermentation and drying, when done appropriately, remove all unpleasant flavors and initiate chemical processes required to produce the true cocoa and chocolate flavours that occurs after roasting. According to Mikkelsen, the factors that affect the quality of the final beans in the fermenting step include degree of ripeness of pods; type of cocoa; climate and season; quantity of cocoa beans in a batch; and duration of fermentation.

Drying is a necessary step in the processing of cocoa. Through this process, the good condition of beans for storage and transport is obtained. It is also necessary to reduce the bitterness and astringency of the beans. Furthermore, it facilitates the development of the chocolate brown color characteristic of well-fermented beans as well as prevent the development of off-flavors within the beans.

In the country, facilities and systems used in drying and fermentation vary. This variation affects the quality of the beans. Agents of multinational companies have their own fermentary facilities, solar dryers, and bean grading kits, while farmers still do the fermentation and drying at their production areas or homes using makeshift equipment. Most likely, the beans are dried on the ground or makeshift platforms, which results in surface contamination that is a major source of fungi in fermented and dried cocoa beans.

Moreover, there is a high risk on mould development during rainy days wherein drying of cocoa beans is done on prolonged periods and on an intermittent basis. This results in off-flavours that is created when the moulds penetrate the testa, which can be a serious problem. On the other hand, when drying is too fast, the oxidation of acetic acid can be prevented. This results in too much acid trapped within the beans, which adversely affects the flavour of the nib.

Competitive Analysis

The cases of Ecuador and Indonesia provide examples of how countries are moving up in the value chain. One of the most important upgrading that the two countries are undertaking is process upgrading at the agricultural level. This is a response to the global trend as cocoa production has remained the same in the past 10 years while demand continues to increase.

Hence, the study conducted by the Duke University entitled "The Philippines in the Cocoa Value Chain" provided upgrading trajectory recommendations. If these will be achieved, the country is expected to move into higher value processing segment of the value chain. The following are the recommendations as stated in the said document:

a. **Short Term Process Upgrading (agriculture):** Taking the lead from major cocoa bean producers, the Philippines needs to improve their agriculture production to be competitive and participate in the cocoa-chocolate GVC. The starting point for the country is to expand and improve the productivity. Aging trees, and inefficient agricultural operations have undermined productivity of the sector. Increasing the production should first satisfy the domestic market and later the international market. This should be the very first step that the country should follow. Efforts to boost processing at this stage will likely drive less expensive beans imports from other countries, and undermine production efforts at home.

b. **Short Term Process Upgrading (certification):** Taking the lead from major cocoa bean producers, the Philippines needs to seek certification from the international certifying organizations, such as UTZ and Rainforest Alliance. While these certifications do not command a high price premium in the market, the commitment of several global cocoa processors and chocolate manufacturers to source only certified beans by 2020 represents a potential shift in the global demand market and new requirement for export. The Philippines needs to begin assisting farmers now to meet the requirements of these organizations to ensure competitiveness as production increases.

c. **Short Term Product Upgrading:** Continue to encourage the diversification of cocoa bean variety in the nation. Since the geography of the Philippines allows for the cultivation of the three major types of beans: Trinitario, Criollo and Forastero, it is advisable that the country diversifies risks by growing all varieties that can cater to different end markets. However, more effort should be done towards diversifying into Forastero beans as demand for Criollo beans is a niche market with relatively small demand. Furthermore, it is advisable to explore high value hybrids to take advantage of new markets and new cocoa bean varieties.

d. **Medium Term Functional Upgrading (manufacturing):** Once the country is able to meet the minimum requirements of cocoa production, manufacturing of the beans will be the next step. Other lead countries such as Ghana, Cote D'Ivoire, and Indonesia have attracted investment from big processors when they secured a good and stable production volume. Olam, Cargill and Barry Callebaut are present in these countries having state-of-the art factories and training specialists to run these cocoa plants that produce cocoa liquor and butter. Hence, this functional upgrading, moving to higher stages of the value chain, will provide additional export revenues as well as new jobs for the country.

MARKET TRENDS AND PROSPECTS

Local

The Philippines is said to be the first country in Asia that planted cacao. The conduciveness of the country's location for cacao production and accessibility to domestic and foreign trade heightened the interest of local farmers and exporters to push for a more dynamic and competitive cacao industry that can participate in the cacao global cacao and chocolate value chain. For this to materialize, there is a need to build and promote a Philippine Cacao Brand.

In 2017, the Cocoa of Excellence Program first recognized cacao-beans from the Philippines as part of the best 50 beans for the said year's edition. The Cocoa of Excellence Program is the first stage for cacao producers to join the International Cocoa Awards (ICA). The ICA is a global competition, coordinated by the Biodiversity International and Event International, that acknowledges the quality, flavor and diversity of cacao according to their origin. This year (2021), one entry from the Davao Region and one entry from Region VI were recognized as gold awardees. In addition, one entry from Davao Region received a silver award.

However, market linkages still remain inefficient which resulted in extensive market failures, high transaction costs and risks, and service gaps. Furthermore, the country is still an importer of cocoa products such as chocolate, cocoa powder, cocoa beans, cocoa paste, cocoa butter and cocoa husks. The large import of cocoa powder and export value of chocolate is being credited to major chocolate manufacturers in the country that seldom buy local cocoa beans. Instead, they use imported powder and cocoa butter for their raw materials. This in effect increases the importation of cocoa powder making it the leading cacao product import in 2014. Consequently, some of the finished by-products produced by local manufacturers are being exported to other countries.

While considered a snack food in developed countries, chocolate in the Philippines is mostly eaten during special occasion or given as gifts. Among the major chocolate manufacturers located in the country are Universal Robina Corporation, Commonwealth Foods, Inc., Goya, Inc., and Columbia International Food Products Inc. Most of these companies are situated in Luzon, with capacity ranging from 20,000 to 36,000 metric tons (MT) of processed cocoa annually. Universal Robina accounts 38% of the chocolate market, with Cloud Nine and Nips as top selling products.

Grinding requirement of local chocolate manufacturers is at 40,000 metric tons (MT) while national production is only at 10,000 metric tons (MT). A portion of this 10,000 metric tons (MT) is also being exported or processed at source, hence, not all local production is being consumed by the local grinders prompting them to import cocoa beans from other countries. It is reported that the Philippines imports 50,000 metric tons (MT) of cocoa and cocoa preparations to meet the local demand.

The presence of players from all stages in the cacao value chain places the Philippines at a competitive edge. Locally, the discrepancy between the grinding requirements of manufacturers and the existing national production entails more opportunities for production expansion to meet local demand. In addition, local processors offer higher buying price for cocoa beans compared to bean exporters.

For bean exporters, more opportunities are open due to the widening of supply and demand gap in the world market. A 10% market share in the world supply may provide a profitable income to the country and its producers.

International

The spread of the COVID-19 pandemic in the early part of 2020 had led to disruptions of supply chains, industries and markets across the globe. Just like the other sectors, the global cocoa and chocolate industry was affected by the changing demand and distribution channels in one way or another. Nevertheless, according to Fortune Business Insights (2020), the global cocoa and chocolate market size is still forecasted to grow exponentially with the increasing demand for specialty and premium chocolates in the

developed economies. The market may hit USD 67.22 billion by 2025 while presenting a compound annual growth rate of 5.7% between 2018 and 2025.

There is also an increasing consumer interest in single-origin chocolates. These are made from cocoa beans produced in a specific country, region or even a specific plantation. Due to the climate and soil, together with the techniques of cacao farming and harvesting, origin chocolates has its own signature flavor profile.

On the other hand, value-added cocoa-based products like chocolates are being made predominantly in non-cacao producing countries such as the United States and European countries. At present, Europe remains the main market for premium quality beans since majority of the grinders are based in the country. Of the 60% world grinding capacity, 39% are from grinders based in Europe, while the remaining 22% are based in America. This elucidates why main exporters of cacao and its preparations in 2015 were from countries in Europe such as Germany and Netherlands. Cacao producing countries such as Cote d'Ivoire and Ghana were the top exporters of cocoa beans in 2015.

With the increasing awareness and concerns on healthy eating, healthy alternatives within chocolate confectionery may be included to the current offerings. Major brands seek to affect the direction of new product development over the next five years. For example, there were reports that Nestlé has created a vegan version of its popular Kit Kat brand of lines (called Kit Kat V). This poses a challenge to cacao producing regions as most of the cacao farms are small holdings owned by farmers who have limited investment.

On the other hand, the growing demand for sustainably produced cocoa beans entails more profitability to farmers, which consequently demands higher prices for the premium quality beans they produce. This is observed over the last decade especially in Northern and Western Europe. In 2018, the World Cocoa Berlin Declaration was released, which recognizes that a sustainable cocoa sector can only be achieved through collaboration. In addition, the first international standard for sustainable and traceable cocoa was published in May 2019. Hence, it is increasingly necessary for producers to transform their current farming practices to more sustainable ones, such as the utilization of fewer synthetic fertilizers and conduct of good water management.

Moreover, supermarkets and sari-sari stores (other grocery retailers) still dominate the distribution of chocolate confectionery in the Philippines and this is expected to continue even with the effect of the COVID 19 pandemic. However, e-commerce is still seen to have some scope for development having made strong gains in chocolate confectionery during 2020 and 2021. In March 2020, the Fine Cacao and Chocolate Institute (FCCI) conducted a survey to better understand the impact of COVID-19 on small chocolate businesses. While several lockdowns were implemented, postage and delivery systems were still operating in different countries. With this, small chocolate businesses used this platform to improve their sales. Thirty percent of those who participated in the survey are planning to move sales entirely online while as much as 59% look forward to boosting digital marketing endeavors over the immediate future. Also, according to National Confectioners Association, online chocolate engagement grew, rising from 25 percent of shoppers in 2018 to 40 percent in 2021.

PRIORITY CONCERNS & OPPORTUNITIES/ CONSTRAINTS & OPPORTUNITIES

The Philippine Cacao Industry Roadmap – Way Forward

This updated Cacao and Chocolate Industry roadmap is a revision of the 2016-2022 Harmonized Cacao Industry Roadmap. It is anchored on the principle of clustering and localization. The approach is scientific and dynamic as it will be backed-up by science and will be evaluated and revised, when deemed necessary, yearly. The aim to be globally competitive and sustainable is in line with the context in making the cacao industry environmentally sound, socially desirable, and economically viable.

One Sector-One Voice is one of the avenues that the cacao stakeholder wants to pursue. Through the leadership of the Philippine Cacao Industry Council (PCIC), in co-leadership with the Department of Agriculture (DA), the Philippine Cacao Industry Association, Inc. (PCIA) will be organized and registered at the Securities and Exchange Commission (SEC) as a private organization composed of cacao industry stakeholders. It will serve as the Private sector partner and counterpart of the PCIC in the promotion of the Cacao Industry through the effective implementation of the Harmonized production and postharvest protocols and Action Plans stipulated in the Cacao and Chocolate Industry Roadmap.

Implementation of the revised roadmap will be localized to ascertain timely and up-to-date execution of programs and plans. Yearly review of the roadmap and assessment of milestones will be performed to ensure that the interventions are properly implemented and to make revisions on the course of action, when deemed necessary. Moreover, active participation in local and international events to promote Philippine Brand of quality cacao will be continued as well as forging linkages with international stakeholders will be strengthened.

On the environmental context, this roadmap seeks to achieve production with special consideration for the environment. Thus Programs, Activities, and Projects (PAPs) that will be undertaken to spur development will be in consonance with environmental preservation and protection.

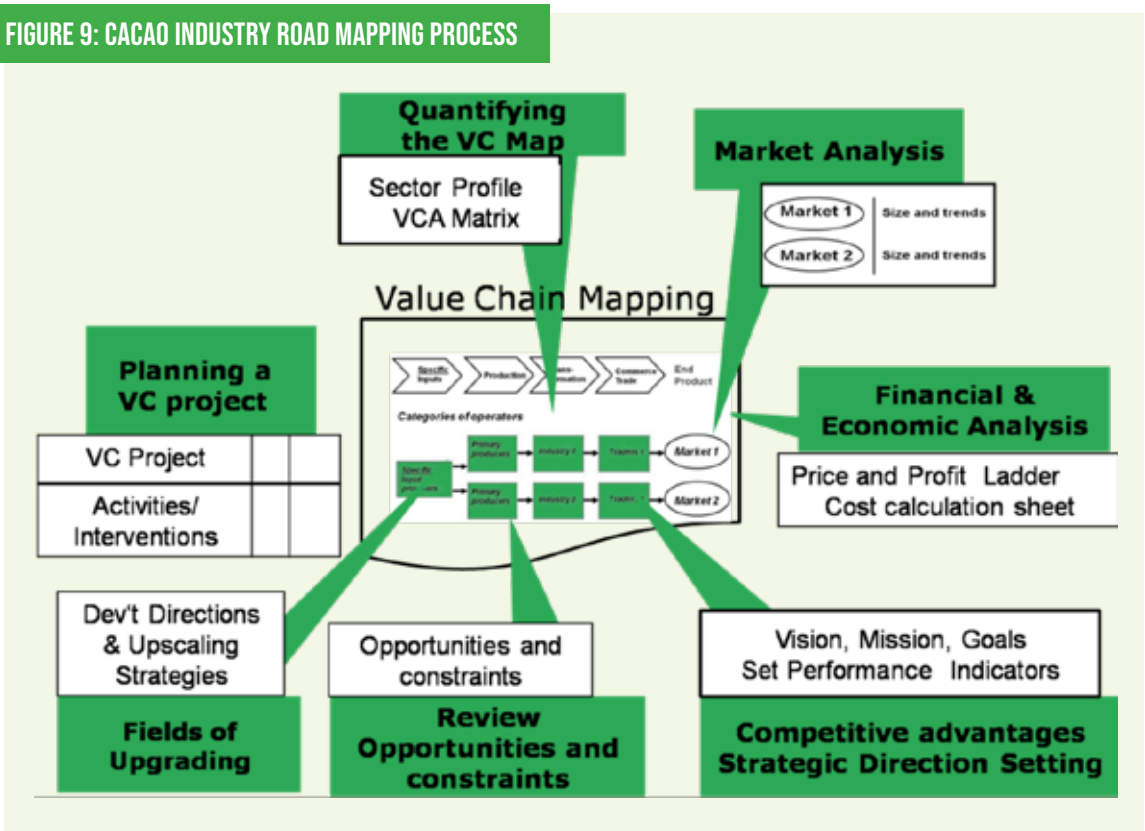
Socially desirable PAPs for the development of cocoa-growing communities are also laid down to ensure human resource development especially in cocoa-growing communities. This is being accompanied with economically viable practices that encourage fair and profitable supply chain with the goal of attaining inclusive business growth with much emphasis on the economic well-being of the cocoa farmers.

Philippine cocoa production is less than 0.1% of the global production. Philippines, Thailand and Vietnam share the 1% out of the 13% production of Asia, while Indonesia and Malaysia share the remaining 12%. The production and market position of the Philippine cocoa bean should be geared towards the Fine Flavour Bean (FFB) so as not to compete in the Bulk Bean (BB) market, which accounts for 95% of the world production. FFB accounts for only 5% of the world production but commands a much higher price.

In addition, production of FFB will provide the right quality of beans needed to support the development of the Philippine Chocolate Industry. This is also one way of de-commoditizing the products so as not to be greatly affected by the price fluctuations in the global market, thus bringing more income to the farmers.

For the aforementioned plans and programs to materialize, it will require a concerted effort among the industry enablers and the private sectors to ensure an improved delivery of service particularly on postharvest facilities, among others. Given this aspiration, stakeholders have set their vision, mission, and goal, which will be the basis and direction of the industry.

FIGURE 9: CACAO INDUSTRY ROAD MAPPING PROCESS



TARGET SETTING

Vision, Mission, Goals and Objectives

The updated Philippine Cacao and Chocolate Industry Roadmap was formulated, drafted and finalized after a series of industry consultations, meetings, and regional convergence sessions. The following are the Vision, Mission, Goal and Objectives that were agreed upon by stakeholders:

VISION

A globally competitive and sustainable Philippine Cacao and Chocolate Industry built on a strong Philippine Brand of quality cacao.

MISSION

Anchored on the principle of strengthened marketing through industry clustering and localization, the Philippine Cacao and Chocolate Industry will be strengthened by 2025 through:

- Nationwide adoption of the upgraded harmonized cacao production and postharvest protocols to pursue poverty alleviation, job generation and environmental protection while advancing economic development and inclusive growth;
- Promotion of cacao production in areas highly suitable for cacao growing to improve farm efficiency and ensure increased farmers' income thereby raising their economic status
- Promotion of continual applied research and development collaborations;
- Mobilization of all stakeholders and relevant government agencies to provide the needed extension support services for concerted industry-wide development efforts;

- Harmonized information gathering to establish a management information system; and
- Stronger participation in the global cacao and chocolate value chain by building and promoting Philippine Brand.

GOAL AND OBJECTIVES

The goal is to produce 50,000 metric tons (MT) of quality fermented beans by 2025 to meet the demand of the export and domestic markets through a 40% annual increase in production.

In order to achieve the 2025 roadmap goal, the following objectives are deemed to be attained:

- To make available and accessible quality cacao planting materials as well as rehabilitate existing 31,000 hectares (600 trees/hectare);
- To increase 7,000 hectares of newly planted trees in 5 years;
- To raise yield to 2 kg/tree/year;
- To ensure availability of quality fermented cocoa beans to support and sustain value-adding activities;
- To contribute to the goal of attaining inclusive growth and poverty alleviation through:
    - ✓ Increase farmers' gross income to at least PhP 130,000 per hectare per year;
    - ✓ Increase export sales by at least USD 75-M by 2025;
    - ✓ Generate at least 17,000 jobs by 2025;
    - ✓ Encourage young people to go into cacao production.

TABLE 14: FINANCIAL REQUIREMENT FOR CACAO PRODUCTION

PROGRAM/ ACTIVITY/ PROJECT	FINANCIAL TARGETS				
	2021	2022	2023	2024	2025
Expansion Area (ha)	35,520,000	53,280,000	79,920,000	127,872,000	204,595,200
Inorganic Fertilizer	750,000	1,125,000	1,687,500	2,700,000	4,320,000
Organic Fertilizer	400,000	600,000	900,000	1,440,000	2,304,000
Training and training-related activities	7,980,000	11,970,000	17,955,000	28,728,000	45,964,800
Technology Demonstration Establishment	16,110,000	24,165,000	36,247,500	57,996,000	92,793,600
Rehabilitation/Rejuvenation of Old trees	12,904,000	19,356,000	29,034,000	46,454,400	74,327,040
Research for Development	5,542,000	8,313,000	12,469,500	19,951,200	31,921,920
Agricultural Machinery, Equipment, Facilities and Infrastructures	21,707,000	32,560,500	48,840,750	78,145,200	125,032,320

*50kg/sack of organic and inorganic fertilizer
* Agricultural Machinery, Equipment, Facilities and Infrastructures (comprises farm production and postharvest-related machinery and equipment, postharvest facilities and irrigation)

RECOMMENDATIONS FOR POLICIES, STRATEGIES AND PROGRAMS

Development Directions and Upscaling Strategies

The constraints and opportunities identified by the stakeholders served as the basis in setting the development directions of this roadmap. This is also aligned to the One DA Reform Agenda: 18 Key Strategies, highlighting the four pillars of consolidation, modernization, industrialization and professionalization. The following development directions need to be noted in the implementation of this roadmap:

- Expansion of production areas in areas suitable for cacao growing based on the Climate and Soil Suitability Map
- Increase in fermented bean productivity level
- Moving Up of the Cacao Industry Value Chain
- Strengthening of Market Presence through Branding
- Focus on Fine Flavour Beans Market
- Apply the principle of clustering, localization and market demands

Aligned with the development directions to strengthen, expand and promote the industry are the seven (7) upscaling strategies, which are as follows:

- Increase production and access to quality planting materials based on the Climate and Soil Suitability Map
- Improve farm productivity by adopting the harmonized production and postharvest protocol
- Aggressive promotion of value-added products
- Strengthen market linkage and Philippine Branding of quality cacao
- Continual research and development across the value chain
- Continual provision of technical support on production, processing and marketing
- Resource generation and mobilization

Cacao Industry Action Plans

The Cacao and Chocolate Industry Action Plan is based on the seven (7) upscaling strategies identified by stakeholders where interventions from the government and the private sector were laid down. This Action Plan will facilitate the convergence and collaboration among stakeholders. Government interventions are distributed based on the agency's mandate.

Through this Action Plan, harmonization and integration of development initiatives from various sectors are made possible. This provides transparency in the programs and projects implementation as well as facilitates stricter and closer monitoring and evaluation of industry performance to achieve the target goals.

The timeframe on this Action Plan is set as follows:

a. Short-term (2021-2025), which coincides with the National Agriculture and Fisheries Modernization and Industrialization Plan (NAFMIP) implementation
b. Medium-term (2026-2030), which coincides with the UN's Sustainable Development Goals (SDG) 2030 deadline
c. Long-term (2031-2040), which coincides with NEDA's AmBisyon 2040

The Roadmap Development Team believes that some activities and programs can be implemented in a year's period, thus a one-year timeframe was included in the Action Plan. These activities and programs falling under the one-year period will be evaluated and modified, when deemed necessary, after a year.

TABLE 15: THE PHILIPPINE CACAO AND CHOCOLATE INDUSTRY ACTION PLAN

Programs, Activities, and Projects	Implementing Agencies	Timeline
Strategy 1: Increase production and access to quality planting materials based on the Climate and Soil Suitability Map		
Establish additional Nurseries & Budwood Gardens at the provincial level	DA, BPI, DA-RFOs, DAR, Cacao stakeholders	Short term- 1st Year
Craft a Harmonized production and postharvest protocols	DA, Academe, Technical experts, Cacao stakeholders	Short term- 1st Year
Strengthen Plant Nursery Accreditation and Certification in the Province and accredit more nurseries in the municipalities	DA, DA BPI accredited nurseries, Farmers, Cacao stakeholders	Short term- 1st Year
Forge partnership between farmer/grower and those with bud wood garden	Cacao stakeholders	Short term- 1st Year
Facilitate national implementation of the Implementing Rules and Regulations (IRR) on genetic material procurement to improve procurement process and delivery system on planting materials	DA, DA BPI, DA RFOs	Short term
Improve planting material distribution (DA to strengthen the existing foundation groves/ budwood gardens as source of propagules for propagation and the LGU to produce quality planting materials)	DA, PCA, DENR, LGU, DAR, Cacao stakeholders	Short term
Assist in the provision supplies and materials to expand the established nurseries	DA, DOST-PCAARRD, BPI, DA RFOs, LGUs	Short term
Facilitate the acquisition and supply of quality planting materials should only be sourced from accredited nursery operators in a particular region/ province	DA, PCA, DAR, LGUs, Cacao stakeholders	Medium term
Provide farm infrastructures (Farm-to-Market Road, Irrigation system)	DA, DA RFOs, DPWH	Medium term

Programs, Activities, and Projects	Implementing Agencies	Timeline
Strategy 2: Improve farm productivity by adopting the harmonized production and post-harvest protocol		
Ensure Good Agricultural Practices (GAP) certification on Cacao in the provincial level	DA, BPI, Cacao stakeholders	Short term- 1st Year
Implement Integrated Pest and Disease Management Program, Plant Nutrition Program and Cultural Practices/Management Program	DA, PhilMech, BPI, DOST Academe, RCPC, Cacao stakeholders	Short term- 1st Year
Provide Postharvest Facilities (Fermentation, Dryers, etc.)	DA, PhilMech	Short term
Strengthen Science and Technology Community-Based Farming (STCBF) Program	DOST-PCAARRD	Short term
Conduct a comprehensive inventory of existing & potential/suitable cacao production areas	DAR, DA, LGU, PCA, DENR, Cacao stakeholders	Short term
Implement massive rehabilitation and maintenance program all-over the country	DA, PCIC Regional Councils	Short term
Establish LGU-recognized model farm in the municipalities or provinces	DA, LGU, Cacao stakeholders, DILG	Short term
Strengthen existing Common Service Facilities to be Linked to Expert Chocolatiers	DA, DOST, DTI, Cacao stakeholders	Short term
Strategy 3: Aggressive promotion of value-added products		
Conduct of Product Development Clinics and Technology upgrading	DTI, DOST	Short term- 1st Year
Provide Cacao Processing Facilities (Common Service Facilities)	DA, DTI, DAR	Short term- 1st Year
Utilize cacao pod husk as fuel briquettes, cellulose acetate, feeds, and pectin as well as cacao dripping as wine, vinegar, ethanol and pectin	PhilMech, DOST	Short term- 1st Year
Build cacao waste village enterprise models in strategic growing areas	PhilMech, DOST, LGU, DA RFO	Short term- 1st Year
Product upgrading focused on high quality cacao mass (Tablea and Chocolate)	DTI, DA, DOST	Short term- 1st Year
Strategy 4: Strengthen market linkage and Philippine Branding of quality cacao		
Establish/upgrade trading post facilities in the regional and provincial level	DA, AMAS, DTI, Cacao stakeholders	Short term- 1st Year

Programs, Activities, and Projects	Implementing Agencies	Timeline
Strongly recommend decentralization of testing hubs for Certificate of Product Registration (CPR) accreditation to simplify/shorten the processing time	DOH-FDA, DA, DTI, Cacao stakeholders, DOST	Short term- 1st Year
Conduct Quality standards & certification advocacy	DA, BAFS, DTI, DOST, PhilMech, Cacao stakeholders, FDA	Short term- 1st Year
Organize the Philippine Cacao Festival	DTI, DA, Cacao stakeholders	Short term- 1st Year
Conduct Annual Celebration of the World Chocolate Day	DTI, DA, Cacao stakeholders	Short term- 1st Year
Develop a local awarding system	DA, DTI, Cacao stakeholders	Short term- 1st Year
Participate in International, National & Regional Exhibits/Fairs	DTI, DA, Cacao stakeholders, DFA	Short term- 1st Year
Participate in the Annual Cocoa of Excellence Competition in Paris, France	DTI, DA, Cacao stakeholders	Short term- 1st Year
Conduct an Orientation on Single Origin, Traceability & Geographic Information System (GIS)	DA, BAFS, BPI, DTI	Short term- 1st Year
Encourage DA-AMAS to be more proactive in its Actions to support the development of the cacao industry	DA, DA AMAS	Short term- 1st Year
Improve Packaging and Labelling	DOST, DTI	Short term
Promote a Collective Trademark/Brand for Philippine Cacao Export Products	DTI, MinDA	Short term
Start the ground work for the International Cocoa Organization (ICCO) membership	DA, DTI, Cacao stakeholders, Philippine Government	Short term
Apply for Certification of Philippines as suppliers of Fine Flavour Cacao Beans	DA, Cacao stakeholders	Short to Medium term
Strengthen market linkages and referrals (local and foreign)	DTI, DA, BOI	Short to Medium term
Conduct of Asia Pacific Cacao Conference	DA, DTI, Cacao stakeholders	Short to Medium term
Define/Develop Standards for Philippine Cacao Products	DA, DTI-BPS, DOST, DA-BAFS	Short to Medium term
Promote the Philippine Brand Quality Cacao Beans and Chocolates Locally and Globally	AMAS, DTI, Cacao stakeholders, MinDA	Medium term

Programs, Activities, and Projects	Implementing Agencies	Timeline
Strategy 5: Continual research and development across the value chain		
Support the Science for Change Programs i.e. Niche Centers in the Regions for R&D; (NICER Program), R&D Leadership (RDLead), Collaborative Research and Development to Leverage Philippine Economy (CRADLE) for RDIs and Industry Program and Business Innovation through S&T (BIST) for Industry Program	BAR, DOST, Cacao stakeholders	Short term- 1st Year
Improve Postharvest Technologies and establish R&D Center including Cacao testing laboratory facilities	UPLB, DOST PHILMECH, Cacao stakeholders, Academe	Short term- 1st Year
Conduct Cacao Industry Profiling, Mapping and Geo-Tagging	DA, DA-RFOs, DAR, DENR, Cacao stakeholders	Short term- 1st Year
Continuously conduct studies on the local and global markets and its channels	DTI, AMAS	Short term- 1st Year
Continuously conduct feasibility and suitability studies based on the suitability map to identify best regions for selected high potential varieties	DA, BAR, DOST, Academe, Cacao stakeholders	Short term- 1st Year
Conduct researches based on the needs of the industry and how to level up the quality of cacao beans	DA, BAR, Academe, Cacao stakeholders, DOST, DTI	Short term- 1st Year
Continuously conduct dissemination, promotion and commercialization of developed technologies/ R&D results	PCIC, DTI, DOST, Academe, Private sector, DA, BAR	Short term- 1st Year
Continuously conduct dissemination, promotion and commercialization of developed technologies/ R&D results	PCIC, DTI, DOST, Academe, Private sector, DA, BAR	Short term- 1st Year
Disseminate information on the existence of R&D centers and its function and services	BAR, DOST, Academe	Short term- 1st Year
Utilize the research stations in the State, Universities and Colleges (SUCs)	DA, DA BAR, Academe, DOST	Short term- 1st Year
Implement Varietal Improvement Program	DA BAR, LGUs, Academe, Cacao stakeholders, DOST-PCAARRD, DA HVC	Short term
Establish additional research centers in different islands	DA, Cacao stakeholders, DOST, Academe	Short term

Programs, Activities, and Projects	Implementing Agencies	Timeline
Analyze high value bean varieties and hybrids available globally for potential production in the country as well as its market demand	DA, DA BAR, Cacao stakeholders	Short to Medium term
Encourage the academe to offer food technology course as part of their curriculum in their respective schools	DOST, Academe	Short to Medium term
Explore R&D Collaborations with Cacao Industry Experts	DA, MinDA, DOST, Academe, DTI	Long term
Conduct of Benchmarking Activities in Malaysia and Indonesia	DA, Academe, DTI	Long term
Strategy 6: Continual provision of technical support on production, processing and marketing		
Validate Regional Cacao Industry Baseline data and improve harmonized data collection with the help of the LGUs to accurately track production and planting in the country to establish Industry Databank	DA, BPI, DAR, DENR, PCA, PSA, Cacao stakeholders, LGUs	Short term- 1st Year
Generate LGU cooperation and support (local policy, resources, data generation)	Cacao stakeholders, LGUs, DILG	Short term- 1st Year
Strengthen capacity building/training of LGUs (MAOs and PAOs) on Cacao	DA, BPI, ATI, Cacao stakeholders	Short term- 1st Year
Conduct farmer's field day and industry forum	DA, DOST-PCARRD, ATI, DTI, LGUs, Cacao stakeholders,	Short term- 1st Year
Collaborate with TESDA on the training plan	DA, ATI, Cacao stakeholders, DTI, TESDA,	Short term- 1st Year
Provide support to Farmer Information Technology (FITS) Centers, School on the Air, Farmers' Field Schools, etc.	DA, ATI, TESDA, Farm Schools, LGUs, NGOs, Cacao stakeholders,	Short term- 1st Year
Conduct Skills and Techno Transfer Training on Postharvest i.e., Cacao Fermentation and Drying	ATI, CIDAMI, DTI, DOST, Cacao stakeholders, TESDA, DA-PhilMech, Farm Schools	Short term- 1st Year
Connect grower associations and processors through contract buying programs	DA, AMAS	Short term- 1st Year
Promote agri-preneur and conduct Agri-preneurship Seminars to enable the farmers to be self-reliant	DA, AMAS, DTI, ATI, Cacao stakeholders,	Short term- 1st Year
Conduct of Productivity Enhancement Trainings	DA, Cacao stakeholders, DTI	Short term- 1st Year

Programs, Activities, and Projects	Implementing Agencies	Timeline
Conduct capacity building for Resource Generation	DA, Cacao stakeholders, Landbank	Short term- 1st Year
Develop and implement specific technical training programs for capabilities gaps	DA, ATI, Cacao stakeholders, TESDA, Farm Schools, NGOs	Short term- 1st Year
Create an Inter-Agency Convergence Initiatives to support Capacity Building Activities for cacao processing	LGUs, DA, DTI, Academe, Cacao stakeholders,	Short term- 1st Year
Conduct Investment and Techno Forum	DTI, DA, CIDAMI, MinDA, Cacao stakeholders,	Short term- 1st Year
Continue the organization of the Philippine Cacao Quality Awards Competition Program (Cacao Beans Award)	DA, PCIC/PCIA	Short term- 1st Year
Encourage youth organizations to participate in the Cacao Industry as agri-preneurs	DA, TESDA, ATI, PCIC/PCIA	Short term- 1st Year
Programs, Activities, and Projects	Implementing Agencies	Timeline
Integrate Gender and Development (GAD) program in capacitating different stakeholders on gender equality and women's empowerment.	DA, GAD, PCIC/PCIA	Short term- 1st Year
Publish a compendium that will compile R&D results	DA, BAR, PCIC/PCIA, Academe, DOST	Short term- 1st Year
Digitalization of the Cacao Industry	DA, PCIC/PCIA, ATI, DTI, Academe	Short term- 1st Year
Conduct capacity building/training of BPI-NSQCS staff on molecular marking/tagging	BPI, DOST-PCAARRD funded project with USM	Short term
Develop and implement traceability training programs for small holders	DA, ATI, PCIC/PCIA	Short term
Strategy 7: Resource generation and mobilization		
Facilitate the involvement of Philippine Cacao Industry Council in the government cacao seedling procurement program	DA, Cacao stakeholders	Short term- 1st Year
Credit Access Facilitation • Inventory of financing programs which can be accessed by cacao growers o Land Bank of the Philippines Cacao 100 o Small Business Corporation (SBC) Financing Program o DA, DAR, and ACPC-administered credit programs	DA, DAR, DTI, LBP, PCIC/ PCIA, ACPC LBP, Cacao stakeholders SBC, DTI, Cacao stakeholders DA, DAR, ACPC (through partner lending conduits)	Short term- 1st Year

Programs, Activities, and Projects	Implementing Agencies	Timeline
Design Special Programs on Credit • Credit & Marketing Assistance Program for Agrarian Reform Beneficiaries Organizations (ARBOs) • Credit facilitation through DA's Loan Facilitation Teams (LoFTs)2	DA, ACPC, LBP, Cacao stakeholders DAR DA, ACPC	Short term- 1st Year
Facilitate financing thru Agrarian Production Credit Program (APCP) & Land Bank of the Philippines	DAR, DA, Cacao stakeholders	Short term- 1st Year
Institutionalize a Convergence Mechanism at Regional Level for the preparation of Agency Budgets and Performance Targets Re: Cacao Industry Development	DA, Cacao stakeholders, DTI, other government agencies, DA RFOs, LGUs	Short term- 1st Year
Institutionalize the membership of the Regional Cacao Industry Councils to the Regional Development Councils (RDC)	DA, DTI, NEDA	Short term- 1st Year
Draft a one-year Action Plan to be drawn from the short-term five-year Action Plan complete with targets, timelines and Persons responsible	Cacao Industry Roadmap Development Team	Short term- 1st Year
Create a Cacao Roadmap Implementation Team to oversee the implementation of the first year Action PLAN. Composed of PCIC, PCIA, DA and DTI; recommended adjustments on the Roadmap as needed.	Cacao Industry Roadmap Development Team	Short term- 1st Year
"Raise funds to re-visit the Cacao Roadmap: (1) to prepare a more in-depth study of the markets (local and international) and (2) conduct more comprehensive studies to identify sites suitable for cacao production based on the Climate and Soils Suitability map for cacao, which will form the basis for PCIC/PCIA strategic Actions following the principles of localization, clustering and market demands."	DA, AMAS, DTI, Cacao stakeholders	Short term- 1st Year
Involve the participation of the different government agencies in the implementation of the Cacao Roadmap to ensure a unified Action at the national and local level	DA agencies, Bureaus and Attached Corporations, Cacao stakeholders, DENR	Short term- 1st Year

Programs, Activities, and Projects	Implementing Agencies	Timeline
Organize the Philippine Cacao Industry Association (PCIA) and register it with the Security and Exchange Commission (SEC) as a private organization	Cacao stakeholders	Short term- 1st Year
Strengthen the collaboration of Regional Councils with the Provincial councils, LGUs (MAOs and PAOs) in support of the implementation of the Mandanas Law	DA, LGUs, Cacao stakeholders	Short term- 1st Year
Achieve international certification for cocoa beans to add more value to the product	DA, DTI, Cacao stakeholders,	Short term- 1st Year
Implement the Credit & Marketing Assistance Program for Agrarian Reform Beneficiaries Organizations (ARBOs)	DAR	Short term

INDUSTRY CLUSTER GOVERNANCE FRAMEWORK

The industry stakeholders recognize the need to strengthen structural capability and control mechanism in the development and promotion of the cacao industry at the national level. Thus, initially, the National Cacao Industry Technical Working Committee (NCITWG) was created on August 2015 to spearhead the cacao industry development and paved the way for the organization of 15 Regional Cacao Industry Development Councils.

At the Regional level, Regional Cacao Industry Councils have been established. These councils spearhead the development of the industry in their respective regions. The elected chairpersons represent their regions at the Philippine National Cacao Industry Council (Philippine Cacao). To date, sixteen (16) regional councils and five (5) provincial councils have already been created.

The finalization of the 2016-2022 Philippine Cacao Industry Roadmap, necessitated the creation of a permanent national structure that will spearhead the cacao industry development thus, the creation of the Philippine Cacao. The Council is expected to attain the following organizational objectives:

- Provide leadership in the cacao industry development;
- Strengthen structural capability and control mechanism in the development and promotion of the cacao industry at the national level;
- Forge/strengthen public and private sector partnership for better coordination of development initiatives; and,
- Represent the industry to international cacao governing bodies;

To ensure a harmonized and synchronized industry development as well as instill a certain level of industry disciple, the following functions and responsibilities of the Philippine Cacao are further defined below:

- Support Passage of House Bill Nos. 1475, 1771, 3253, 4082, 5344, 5585 and 6429 known as the "Philippine Cacao Industry Development Act";
- Spearhead the development and promotion of the Philippine Cacao Industry;
- Assist in organizing the Philippine Cacao Industry Association (PCIA), which will be registered at the Securities and Exchange Commission (SEC) as a private organization;
- Formulate/advocate industry-related policies;
- Serve as the forum and coordinating body to discuss strategic issues affecting the cacao industry at the national level;
- Integrate and harmonize development efforts, programs and projects of the private and government sectors;
- Conceptualize, recommend, and monitor/evaluate project implementation;
- Promote transparency on project implementation; and
- Establish/harmonize cacao technical production and postharvest protocol.

The Council is composed of public and private sectors, with at least 60% of the members coming from the latter. Government representatives are from agencies involved in the development and promotion of the cacao industry. On the other hand, the private sector is composed of chairpersons of the Regional Cacao Industry Development Councils and representatives of cacao industry organizations that are national in scope.

The Council is a private sector led, thus representative from the private sector take the chairmanship and co-chaired by the DA being the lead government agency. There are two (2) vice chairpersons, one from the private and another from the government sector with the latter represented by the DTI. The DTI-XI, being the DTI National Cacao Industry Cluster Coordinator of the agency, serves as the Council's secretariat in close coordination with the DA-BPI. Tenure of office shall be two (2) years. (see Appendix 4)

Monitoring and Evaluation

The PCIC/PCIA together with the Cacao Roadmap Development Team (RDT) is committed in ensuring that the target goals will be achieved and the action plans be delivered. Close monitoring and yearly re-visitation of the roadmap will be done in order to make the necessary adjustments on programs and activities identified.

The PCIC/PCIA once established will come up with a harmonized data collection and monitoring and evaluation system to keep track of the development of the industry. This will involve the participation of all stakeholders particularly the participating government institutions as they will be required to submit periodic report.

Through the harmonized data collection, which will be facilitated with the help of LGUs, a more accurate tracking of production and planting are expected to be achieved thereby narrowing, if not eliminating, data gaps particularly on the production area, volume of production and productivity level.

Monitoring Report Forms will be developed and distributed to concerned agencies for periodic submission. This will be consolidated by the secretariat and presented to the council every semester for evaluation.

TABLE 16. INDUSTRY CLUSTER GOVERNANCE NETWORK

ROLES	ACTORS	RESPONSIBILITIES
Overall implementing and monitoring body	• Department of Agriculture • National High Value Crops Development Program • Department of Trade and Industry	Spearhead the implementation of the strategies and programs in the Philippine Cacao Industry Roadmap
		Conduct an internal periodic review of the Roadmap
		Mediate planning and regular consultations between the public and provate sectors
		Establish partnership with private investors/ companies and tap foreign funding institutions

ROLES	ACTORS	RESPONSIBILITIES
Implementing Agency	Private Sector	Private counterpart support to scale-up investments
	• DA Regional Field Offices • DA Services, Bureaus & Attached Agencies • State Universities and Colleges (SUCs) • Other National Government Agencies • Local Government Units	Implement the targets and strategies identified in the roadmap
Monitoring Agency	PCAF, DA-PMED, PSA	Conduct periodic assessment of the roadmap implementation

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APPENDICES

APPENDIX 1: AGRO-CLIMATIC REQUIREMENTS FOR GROWTH AND DEVELOPMENT OF CACAO

FACTORS	CACAO
Elevation (MASL)	300 – 1,200
Temperature (oC)	Minimum of 18°C and maximum of 30-32°C
Soil pH	5.0 – 7.5
Soil Depth	150
Organic Matter (OM)	Rich in organic matter
Relative Humidity (%)	75-90
Rainfall (mm)	1,250 to 3,000 mm per annum

*A suitable temperature is generally observed at an altitude up to 700 m.
*Cacao thrives best under Type IV climate which has an evenly distributed rainfall throughout the year.

Selecting a suitable cacao growing farm is vital in order to ensure maintaining cacao tree's vitality and productivity (refer to Annexes: Climate and Soil Suitability Map). An elevation of 300-1,200 meters above sea level (MASL) is recommended with soil depth of 150 cm and pH level from 5.0 to 7.5. The area needs to be rich in compounds that serves as reservoir of nutrients such as organic matter. Cacao thrives best under Type IV climate, which has an evenly distributed rainfall throughout the year as the ideal rainfall is about 1,250 to 3,000 mm. However, in areas where lesser rainfall occurs, an irrigation system is recommended. On the other hand, the temperature should be from 18oC to 32oC with 75-90% relative humidity.

The Philippines is among the countries in Asia seen to have a competitive advantage on cacao production given its strategic location and climatic condition. The three (3) million (M) hectares of coconut farms ideal for cacao intercropping supplement the industry's competitive advantage.

Climate of the Philippines

The Climate of the Philippines is tropical and maritime. It is characterized by relatively high temperature, high humidity and abundant rainfall. It is similar in many respects to the climate of the countries of Central America. Temperature, humidity, and rainfall, which are discussed hereunder, are the most important elements of the country's weather and climate.

Temperature

Based on the average of all weather stations in the Philippines, excluding Baguio, the mean annual temperature is 26.6o C. The coolest months fall in January with a mean temperature of 25.5oC while the warmest month occurs in May with a mean temperature of 28.3oC. Latitude is an insignificant factor in the variation of temperature while altitude shows greater contrast in temperature. Thus, the mean annual temperature of Baguio with an elevation of 1,500 meters is 18.3oC. This makes the temperature of Baguio comparable with those in the temperate climate and because of this, it is known as the summer capital of the Philippines.

The difference between the mean annual temperature of the southernmost station in Zamboanga and that of the northermost station in Laoag is insignificant. In other words, there is essentially no difference in the mean annual temperature of places in Luzon, Visayas or Mindanao measured at or near sea level.

Humidity

Humidity refers to the moisture content of the atmosphere. Due to high temperature and the surrounding bodies of water, the Philippines has a high relative humidity. The average monthly relative humidty varies between 71 percent in March and 85 percent in September. The combination of warm temperature and high relative and absolute humidities give rise to high sensible temperature throughout the archipelago. It is especially uncomfortable during March to May, when temperature and humidity attain their maximum levels.

Rainfall

Rainfall is the most important climatic element in the Philippines. Rainfall distribution throughout the country varies from one region to another, depending upon the direction of the moisture-bearing winds and the location of the mountain systems.

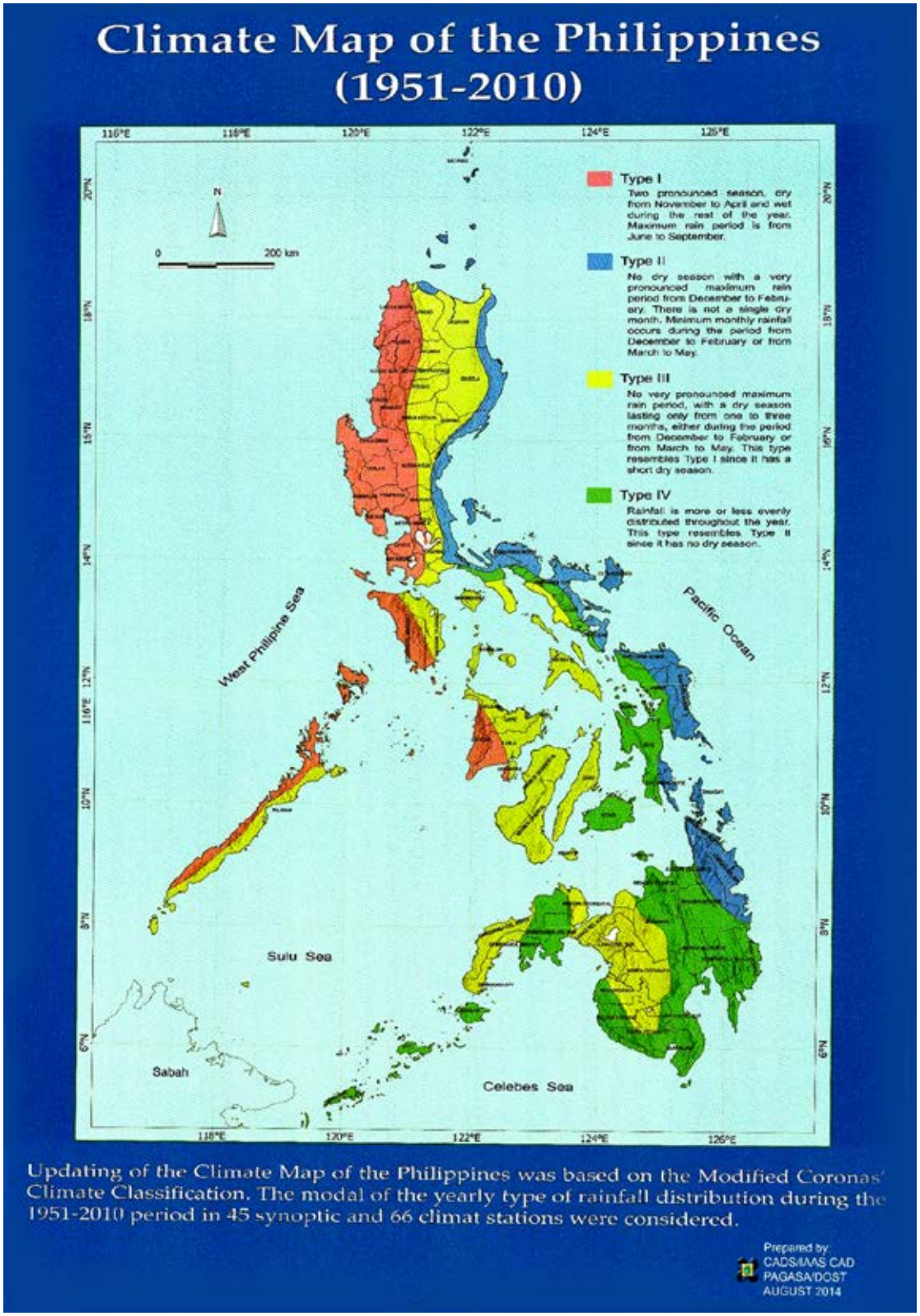
The mean annual rainfall of the Philippines varies from 965 to 4,064 millimeters annually. Baguio City, eastern Samar, and eastern Surigao receive the greatest amount of rainfall

while the southern portion of Cotabato receives the least amount of rain. At General Santos City in Cotabato, the average annual rainfall is only 978 millimeters.

The Seasons

Using temperature and rainfall as bases, the climate of the country can be divided into two major seasons: (1) the rainy season, from June to November; and (2) the dry season, from December to May. The dry season may be subdivided further into (a) the cool dry season, from December to February; and (b) the hot dry season, from March to May.

APPENDIX 2: CLIMATE SUITABILITY MAP



APPENDIX 3. LAND SUITABILITY MAP

LAND SUITABILITY MAP FOR CACAO

LAND RESOURCES EVALUATION AND SUITABILITY ASSESSMENT OF STRATEGIC PRODUCTION AREAS

APAYAO, CAR

EXTENT OF SUITABILITY FOR CACAO PRODUCTION BY MUNICIPALITY

MUNICIPALITY	EXISTING CACAO (Ha)			TOTAL EXISTING AREA (Ha)	EXPANSION AREA (Ha)						CONFLICT RESOLUTION (Ha)								TOTAL POTENTIAL EXPANSION AREA (Ha)
					Coconut		Shrubland, unmanaged*		Grassland, unmanaged*		Corn		Rice paddy, non-irrigated		Mango		Other crops		
	S1	S2	S3		S1	S2	S1	S2	S1	S2	S1	S2	S1	S2	S1	S2	S1	S2	
CALANASAN	4	1	833	838	-	-	366	-	172	4	147	14	108	7	-	-	-	-	818
CONNER	76	-	66	142	286	15	1,720	332	4,234	1,601	2,362	124	612	87	10	-	-	-	11,386
FLORA	-	-	-	-	-	-	7,572	113	3,933	25	1,170	5	1,467	62	1	-	-	-	14,349
KABUGAO	-	-	21	21	-	-	3,072	66	287	38	884	-	137	-	-	-	-	-	4,485
LUNA	-	36	14	50	-	-	1,777	278	1,398	87	1,470	108	1,520	258	-	-	-	-	6,896
PUDTOL	48	-	25	73	-	-	3,541	102	1,559	15	1,163	393	994	564	-	-	-	-	8,331
SANTA MARCELA	32	-	-	32	-	-	339	-	89	-	2,148	95	1,066	121	-	-	-	-	3,857
TOTAL	160	37	960	**1,158**	286	15	18,386	892	11,673	1,770	9,343	739	5,904	1,099	11	-	-	-	**50,119**

Note: Delivery of cacao planting materials must be started on the onset of rainy season.
**establishment of shade trees prior to planting of cacao.*

SUITABILITY CLASSES:

Highly Suitable (S1)
Land having no significant limitation to sustained application of a given use, or only minor limitations that will not significantly reduce productivity or benefits and will not raise inputs above an acceptable level,

Marginally Suitable (S3)
Land having limitations which in aggregate are severe for sustained application of a given use and will so reduce productivity or benefits, or increase required inputs, that this expenditure will be only marginally justified,

Moderately Suitable (S2)
Land having limitation which in aggregate are moderately severe for sustained application of a given use; the limitation will reduce productivity or benefits and increase required inputs to the extent that the overall advantage to be gained from the use, although still attractive, will be appreciably inferior to that expected on class S1 land,

Not Suitable / Not Relevant
Land having limitations which may be surmountable in time but which cannot be corrected with existing knowledge at currently acceptable cost; the limitations are so severe as to preclude successful sustained use of the land in the given manner, Existing forest, shrubland greater than 18% slope, irrigated paddy rice and miscellaneous land types such as built up areas, roads, etc are considered as not relevant,

AGRONOMIC REQUIREMENT OF CACAO PRODUCTION

LAND UTILIZATION TYPE	SUITABILITY RATING	SLOPE (%)	SOIL DEPTH (cm)	SOIL TEXTURE	SOIL DRAINAGE	SOIL REACTION (pH)	INHERENT FERTILITY	FLOODING CLASS	EROSION CLASS	ROCK OUTCROPS	ELEVATION (masl)	ANNUAL RAINFALL (mm)	CLIMATIC TYPE
Cacao	S1	<8	>100	CL, SiCL, SCL, SC, SiC, C, HC	WD,MWD	5.6 -7.2	high	none-slight	none-slight	none-few	<1000	2001-4500	I, III, IV
	S2	8 - 30	50 - 100	FSL, L, SiL	SPD,PD	5.1 - 5.5 7.3 - 7.8	medium	moderate	moderate	common	1000-1500	1000-2000	I, II
	S3	>30	<50	S, LS, CSL, SL	VPD,ED	<5.0 - > 7.9	low	severe	severe	many	>1500	<1000 >4500	

SLOPE (%)
0 - 3 - level to gently sloping
3 - 8 - gently sloping to undulating
8 - 18 - undulating to rolling
18 - 30 - rolling to moderately steep
30 - 50 - steep
> 50 - very steep

SOIL DEPTH (cm)
0 - 30 - very shallow
30 - 50 - shallow
50 - 100 - moderately deep
> 100 - deep to very deep

SOIL DRAINAGE
ED - excessively drained
WD - well drained
MWD - moderately well drained
SPD - somewhat poorly drained
PD - poorly drained
VPD - very poorly drained

SURFACE IMPEDIMENT
ROCK OUTCROPS
< 10% - none - few
10 - 30% - common
> 30% - many

SOIL REACTION (pH)
< 4.5 - extremely acid
4.5 - 5.0 - very strongly acid
5.1 - 5.5 - strongly acid
5.6 - 6.0 - medium acid
6.1 - 6.5 - slightly acid
6.6 - 7.2 - neutral
7.3 - 7.8 - mildly alkaline
7.9 - 8.4 - moderately alkaline
> 8.5 - strongly alkaline

SOIL TEXTURE
Coarse
S - sand
LS - loamy sand
CSL - coarse sandy loam
SL - sandy loam
Medium
FSL - fine sandy loam
L - loam
SiL - silt loam
CL - clay loam
SiCL - silty clay loam
SCL - sandy clay loam
Fine
SC - sandy clay
SiC - silty clay
C - clay
HC - heavy clay

CLIMATE TYPE

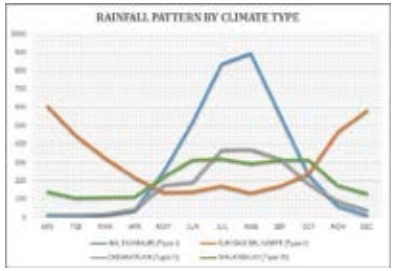
TYPE I : Two pronouced season, dry from November to April and wet during the rest of the year. Maximum rain period is from June to September

TYPE II : No dry season with a very pronounced maximum rain period from December to February. There is not a single dry month. Maximum monthly rainfall occurs during the period from March to May.

TYPE III : No very pronounced maximum rain period, with a dry season lasting only from one to three months, either during the period from December to February or from March to May. This type resembles Type I since it has a short dry season.

TYPE IV : Rainfall is more or less evenly distributed throughout the year. This type resembles Type II since it has no dry season.

Mostly in the Northeastern part of the Apayao lies on Type III climate classification and the rest of the province is Type I.



Source: PAGASA 2018, *Climatological Normals (Rainfall)*, Philippine Atmospheric, Geophysical and Astronomical Services Administration (PAGASA), accessed 27 July 2018, <https://www1.pagasa.dost.gov.ph/index.php/climate/climatological-normals>.

LAND LIMITATIONS DESCRIPTION AND COMBINATIONS

ELEVATION
El2 - 1000m - 1500m
El3 - > 1500m

SLOPE/TOPOGRAPHY
T2 - Undulating to moderately steep
T3 - Steep to very steep

SOIL DRAINAGE
D2 - Somewhat poorly drained to poorly drained
D3 - Very poorly drained or excessively drained

SOIL TEXTURE
Tc - Coarse texture

SOIL DEPTH
Sh2 - Moderately deep (50 - 100cm)
Sh3 - Very shallow to shallow (< 50cm)

ROCK OUTCROPS
Rc2 - Common
Rc3 - Many

SOIL EROSION
E2 - Moderate erosion
E3 - Severe erosion

FLOODING
F2 - Moderate seasonal flooding
F3 - Severe seasonal flooding

CODE	LAND LIMITATION	CODE	LAND LIMITATION	CODE	LAND LIMITATION	CODE	LAND LIMITATION	CODE	LAND LIMITATION
1	E2-Sh2-Rc2	11	El3-Sh2-Rc3	21	T2-El2-E3	31	T3-E3	41	T3-El2-E3-Sh3-Rc2
2	El2	12	F2-D2	22	T2-El2-E3-Rc2	32	T3-E3-Rc2	42	T3-El2-E3-Sh3-Rc3
3	El2-E2-Sh2-Rc3	13	Sh2	23	T2-El2-E3-Rc3	33	T3-E3-Rc3	43	T3-El3
4	El2-E3-Sh2-Rc3	14	Sh2-Rc2	24	T2-El2-E3-Sh2-Rc2	34	T3-E3-Sh3-Rc2	44	T3-El3-E3
5	El2-Rc2	15	T2	25	T2-El2-E3-Sh2-Rc3	35	T3-E3-Sh3-Rc3	45	T3-El3-E3-Sh2-Rc3
6	El2-Sh2-Rc2	16	T2-E3	26	T2-El3-E3	36	T3-El2	46	T3-El3-E3-Sh3-Rc3
7	El2-Sh2-Rc3	17	T2-E3-Rc2	27	T2-El3-E3-Rc3	37	T3-El2-E3		
8	El3	18	T2-E3-Sh2-Rc2	28	T2-El3-E3-Sh2-Rc3	38	T3-El2-E3-Rc2		
9	El3-E3-Sh2-Rc3	19	T2-E3-Sh2-Rc3	29	T2-F2-D2	39	T3-El2-E3-Rc3		
10	El3-Sh2-Rc2	20	T2-El2	30	T3	40	T3-El2-E3-Sh2-Rc3		

CODE	LAND USE
2	Rice paddy, non-irrigated
4	Corn
81	Coffee
82	Cacao
85	Mango
116	Coconut
126	Grassland
134	Shrubs, unmanaged

LAND SUITABILITY MAP FOR CACAO

LAND RESOURCES EVALUATION AND SUITABILITY ASSESSMENT OF STRATEGIC PRODUCTION AREAS

BENGUET, CAR

EXTENT OF SUITABILITY FOR CACAO PRODUCTION BY MUNICIPALITY

MUNICIPALITY	EXISTING CACAO (Ha)			TOTAL EXISTING AREA (Ha)	EXPANSION AREA (Ha)						CONFLICT RESOLUTION (Ha)						TOTAL POTENTIAL EXPANSION AREA (Ha)
					Coconut		Shrubland, unmanaged		Grassland, unmanaged*		Vegetable		Rice paddy, non-irrigated		Other Crops		
	S1	S2	S3		S1	S2	S1	S2	S1	S2	S1	S2	S1	S2	S1	S2	
ATOK	-	-	-	-	-	-	-	-	-	30	-	-	-	-	-	-	30
BAGUIO CITY	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BAKUN	-	-	-	-	-	-	55	-	77	-	-	11	-	-	-	-	143
BOKOD	-	-	-	-	-	-	-	7	-	25	-	-	-	-	-	-	31
BUGUIAS	-	-	-	-	-	-	-	-	-	-	-	4	-	-	-	-	4
ITOGON	-	-	-	-	-	-	31	-	122	16	-	-	11	-	-	-	180
KABAYAN	-	-	-	-	-	-	-	-	-	25	-	4	-	-	-	-	30
KAPANGAN	-	-	-	-	-	-	-	-	-	19	-	14	-	-	-	-	33
KIBUNGAN	-	-	-	-	-	-	-	-	-	13	-	18	-	-	-	-	31
LA TRINIDAD	-	-	-	-	-	-	-	-	-	1	-	171	-	-	-	-	172
MANKAYAN	-	-	-	-	-	-	-	-	-	3	-	1	-	-	-	-	4
SABLAN	-	-	-	-	-	-	44	2	20	1	13	-	60	5	-	-	145
TUBA	-	-	-	-	-	-	22	-	51	172	61	78	6	-	-	-	389
TUBLAY	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TOTAL	-	-	-	-	-	-	97	64	193	382	73	301	77	5	-	-	**1,193**

Note: Delivery of cacao planting materials must be started on the onset of rainy season.
**establishment of shade trees prior to planting of cacao.*

SUITABILITY CLASSES:

Highly Suitable (S1)
Land having no significant limitation to sustained application of a given use, or only minor limitations that will not significantly reduce productivity or benefits and will not raise inputs above an acceptable level.

Marginally Suitable (S3)
Land having limitations which in aggregate are severe for sustained application of a given use and will so reduce productivity or benefits, or increase required inputs, that this expenditure will be only marginally justified.

Moderately Suitable (S2)
Land having limitation which in aggregate are moderately severe for sustained application of a given use; the limitation will reduce productivity or benefits and increase required inputs to the extent that the overall advantage to be gained from the use, although still attractive, will be appreciably inferior to that expected on class S1 land.

Not Suitable / Not Relevant
Land having limitations which may be surmountable in time but which cannot be corrected with existing knowledge at currently acceptable cost; the limitations are so severe as to preclude successful sustained use of the land in the given manner. Existing forest, shrubland greater than 18% slope, irrigated paddy rice and miscellaneous land types such as built up areas, roads, etc are considered as not relevant.

AGRONOMIC REQUIREMENT OF CACAO PRODUCTION

LAND UTILIZATION TYPE	SUITABILITY RATING	SLOPE (%)	SOIL DEPTH (cm)	SOIL TEXTURE	SOIL DRAINAGE	SOIL REACTION (pH)	INHERENT FERTILITY	FLOODING CLASS	EROSION CLASS	ROCK OUTCROPS	ELEVATION (masl)	ANNUAL RAINFALL (mm)	CLIMATIC TYPE
Cacao	S1	<8	>100	CL, SiCL, SCL, SC, SiC, C, HC	WD,MWD	5.6 - 7.2	high	none-slight	none-slight	none-few	<1000	2001-4500	I, III, IV
	S2	8 - 30	50 - 100	FSL, L, SiL	SPD,PD	5.1 - 5.5 7.3 - 7.8	medium	moderate	moderate	common	1000-1500	1000-2000	I, II
	S3	>30	<50	S, LS, CSL, SL	VPD,ED	<5.0 - > 7.9	low	severe	severe	many	>1500	<1000 >4500	

SLOPE (%)
0 - 3 - level to gently sloping
3 - 8 - gently sloping to undulating
8 - 18 - undulating to rolling
18 - 30 - rolling to moderately steep
30 - 50 - steep
> 50 - very steep

SOIL DEPTH (cm)
0 - 30 - very shallow
30 - 50 - shallow
50 - 100 - moderately deep
> 100 - deep to very deep

SOIL DRAINAGE
ED - excessively drained
WD - well drained
MWD - moderately well drained
SPD - somewhat poorly drained
PD - poorly drained
VPD - very poorly drained

SURFACE IMPEDIMENT
ROCK OUTCROPS
< 10% - none - few
10 - 30% - common
> 30% - many

SOIL REACTION (pH)
< 4.5 - extremely acid
4.5 - 5.0 - very strongly acid
5.1 - 5.5 - strongly acid
5.6 - 6.0 - medium acid
6.1 - 6.5 - slightly acid
6.6 - 7.2 - neutral
7.3 - 7.8 - mildly alkaline
7.9 - 8.4 - moderately alkaline
> 8.5 - strongly alkaline

SOIL TEXTURE
Coarse
S - sand
LS - loamy sand
CSL - coarse sandy loam
SL - sandy loam
Medium
FSL - fine sandy loam
L - loam
SiL - silt loam
CL - clay loam
SiCL - silty clay loam
SCL - sandy clay loam
Fine
SC - sandy clay
SiC - silty clay
C - clay
HC - heavy clay

CLIMATE TYPE

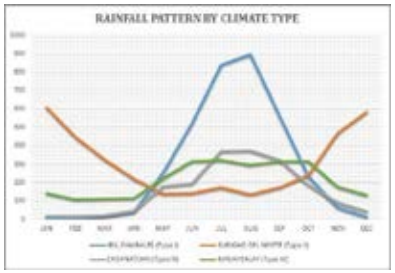
TYPE I : Two pronouced season, dry from November to April and wet during the rest of the year. Maximum rain period is from June to September

TYPE II : No dry season with a very pronounced maximum rain period from December to February, There is not a single dry month. Maximum monthly rainfall occurs during the period from March to May.

TYPE III : No very pronounced maximum rain period, with a dry season lasting only from one to three months, either during the period from December to February or from March to May. This type resembles Type I since it has a short dry season.

TYPE IV : Rainfall is more or less evenly distributed throughout the year. This type resembles Type II since it has no dry season.

The whole part of Benguet classified as climatic Type I.



Source: PAGASA 2018, *Climatological Normals (Rainfall)*, Philippine Atmospheric, Geophysical and Astronomical Services Administration (PAGASA), accessed 27 July 2018, <https://www1.pagasa.dost.gov.ph/index.php/climate/climatological-normals>.

LAND LIMITATIONS DESCRIPTION AND COMBINATIONS

ELEVATION
EI2 - 1000m- 1500m
EI3 - > 1500m

SLOPE/TOPOGRAPHY
T2 - Undulating to moderately steep
T3 - Steep to very steep

SOIL DRAINAGE
D2 - Somewhat poorly drained to poorly drained
D3 - Very poorly drained or excessively drained

SOIL TEXTURE
Tc - Coarse texture

SOIL DEPTH
Sh2 - Moderately deep (50 - 100cm)
Sh3 - Very shallow to shallow (< 50cm)

ROCK OUTCROPS
Rc2 - Common
Rc3 - Many

SOIL EROSION
E2 - Moderate erosion
E3 - Severe erosion

FLOODING
F2 - Moderate seasonal flooding
F3 - Severe seasonal flooding

CODE	LAND LIMITATION	CODE	LAND LIMITATION	CODE	LAND LIMITATION	CODE	LAND LIMITATION	CODE	LAND LIMITATION
1	EI2	11	Rc2	21	T2-EI2-E3-Rc3	31	T3-E3	41	T3-EI2-E3-Sh2-Rc3
2	EI2-E2-Sh2-Rc3	12	T2	22	T2-EI2-E3-Sh2-Rc2	32	T3-E3-Rc2	42	T3-EI2-E3-Sh3-Rc2
3	EI2-E3-Sh2-Rc3	13	T2-EI3	23	T2-EI2-E3-Sh2-Rc3	33	T3-E3-Rc3	43	T3-EI2-E3-Sh3-Rc3
4	EI2-Sh2-Rc2	14	T2-E3-Rc2	24	T2-EI3	34	T3-E3-Sh2-Rc3	44	T3-EI3
5	EI2-Sh2-Rc3	15	T2-E3-Rc3	25	T2-EI3-E3	35	T3-E3-Sh3-Rc2	45	T3-EI3-E3
6	EI3	16	T2-E3-Sh2-Rc2	26	T2-EI3-E3-Rc2	36	T3-E3-Sh3-Rc3	46	T3-EI3-E3-Rc2
7	EI3-E2-Sh2-Rc3	17	T2-E3-Sh2-Rc3	27	T2-EI3-E3-Rc3	37	T3-EI2	47	T3-EI3-E3-Rc3
8	EI3-E3-Sh2-Rc3	18	T2-EI2	28	T2-EI3-E3-Sh2-Rc2	38	T3-EI2-E3	48	T3-EI3-E3-Sh2-Rc3
9	EI3-Sh2-Rc2	19	T2-EI2-E3	29	T2-EI3-E3-Sh2-Rc3	39	T3-EI2-E3-Rc2	49	T3-EI3-E3-Sh3-Rc2
10	EI3-Sh2-Rc3	20	T2-EI2-E3-Rc2	30	T3	40	T3-EI2-E3-Rc3	50	T3-EI3-E3-Sh3-Rc3

CODE	LAN DUSE
2	Paddy rice, non-irrigated
47	Vegetable
81	Coffee
126	Grassland
133	Bamboo
134	Shrubland, unmanaged

LAND SUITABILITY MAP FOR CACAO

LAND RESOURCES EVALUATION AND SUITABILITY ASSESSMENT OF STRATEGIC PRODUCTION AREAS

KALINGA, CAR

EXTENT OF SUITABILITY FOR CACAO PRODUCTION BY MUNICIPALITY

MUNICIPALITY	EXISTING CACAO (Ha)			TOTAL EXISTING AREA (Ha)	EXPANSION AREA (Ha)						CONFLICT RESOLUTION (Ha)						TOTAL POTENTIAL EXPANSION AREA (Ha)
					Coconut		Shrubland, unmanaged*		Grassland, unmanaged*		Rice paddy, non-irrigated		Corn		Other crops		
	S1	S2	S3		S1	S2	S1	S2	S1	S2	S1	S2	S1	S2	S1	S2	
BALBALAN	-	-	11	11	-	-	108	15	8	8	7	-	7		-	-	152
CITY OF TABUK	82	-	175	257	-	-	2,393	8	13,149	66	7,304	-	7,199		-	-	30,120
LUBUAGAN	-	-	83	83	-	-	24	-	23	8	-	-	97	11	-	-	162
PASIL	-	-	36	36	-	-	-	-	7	-	-	-	39		-	-	46
PINUKPUK	103	-	382	485	71	-	493	22	5,051	60	1,904	28	3,482	141	1	-	11,252
RIZAL	4	-	47	51	75	-	32		3,713		4,040	-	1,783		-	-	9,645
TANUDAN	-	-	11	11	-	-	682	46	1,110	58	188	7	707	98	-	-	2,895
TINGLAYAN	-	-	-	-	-	-	13	9	20	-	-	-	37	13	-	-	93
TOTAL	189	-	744	933	146	-	3,745	100	23,081	199	13,444	35	13,351	263	1	-	54,364

Note: Delivery of cacao planting materials must be started on the onset of rainy season.
**establishment of shade trees prior to planting of cacao.*

AGRONOMIC REQUIREMENT OF CACAO PRODUCTION

LAND UTILIZATION TYPE	SUITABILITY RATING	SLOPE (%)	SOIL DEPTH (cm)	SOIL TEXTURE	SOIL DRAINAGE	SOIL REACTION (pH)	INHERENT FERTILITY	FLOODING CLASS	EROSION CLASS	ROCK OUTCROPS	ELEVATION (masl)	ANNUAL RAINFALL (mm)	CLIMATIC TYPE
Cacao	S1	<8	>100	CL, SICL, SCL, SC, SiC, C, HC	WD,MWD	5.6 -7.2	high	none-slight	none-slight	none-few	<1000	2001-4500	I, III, IV
	S2	8 - 30	50 - 100	FSL, L, SiL	SPD,PD	5.1 - 5.5 7.3 - 7.8	medium	moderate	moderate	common	1000-1500	1000-2000	I, II
	S3	>30	<50	S, LS, CSL, SL	VPD,ED	<5.0 - > 7.9	low	severe	severe	many	>1500	<1000 >4500	

SLOPE (%)
0 - 3 - level to gently sloping
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8 - 18 - undulating to rolling
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30 - 50 - steep
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ED - excessively drained
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MWD - moderately well drained
SPD - somewhat poorly drained
PD - poorly drained
VPD - very poorly drained

SURFACE IMPEDIMENT
ROCK OUTCROPS
< 10% - none - few
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> 30% - many

SOIL REACTION (pH)
< 4.5 - extremely acid
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6.1 - 6.5 - slightly acid
6.6 - 7.2 - neutral
7.3 - 7.8 - mildly alkaline
7.9 - 8.4 - moderately alkaline
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SOIL TEXTURE
Coarse
S - sand
LS - loamy sand
CSL - coarse sandy loam
SL - sandy loam
Medium
FSL - fine sandy loam
L - loam
SiL - silt loam
CL - clay loam
SiCL - silty clay loam
SCL - sandy clay loam
Fine
SC - sandy clay
SiC - silty clay
C - clay
HC - heavy clay

LAND LIMITATIONS DESCRIPTION AND COMBINATIONS

ELEVATION
El2 - 1000m - 1500m
El3 - > 1500m

SLOPE/TOPOGRAPHY
T2 - Undulating to moderately steep
T3 - Steep to very steep

SOIL DRAINAGE
D2 - Somewhat poorly drained to poorly drained
D3 - Very poorly drained or excessively drained

SOIL TEXTURE
Tc - Coarse texture

SOIL DEPTH
Sh2 - Moderately deep (50 - 100cm)
Sh3 - Very shallow to shallow (< 50cm)

ROCK OUTCROPS
Rc2 - Common
Rc3 - Many

SOIL EROSION
E2 - Moderate erosion
E3 - Severe erosion

FLOODING
F2 - Moderate seasonal flooding
F3 - Severe seasonal flooding

CODE	LAND LIMITATION	CODE	LAND LIMITATION	CODE	LAND LIMITATION	CODE	LAND LIMITATION
1	E2-Sh2-Rc2	12	Sh2-Rc2	23	T2-El3	34	T3-El2-E3-Rc2
2	El2	13	T2	24	T2-El3-E3	35	T3-El2-E3-Rc3
3	El2-E3-Sh2-Rc3	14	T2-E3	25	T2-El2-E3-Rc3	36	T3-El2-E3-Sh2-Rc3
4	El2-Rc2	15	T2-E3-Rc2	26	T2-El3-El3-Sh2-Rc2	37	T3-El2-E3-Sh3-Rc2
5	El2-Sh2-Rc2	16	T2-E3-Sh2-Rc2	27	T2-El3-E3-Sh2-Rc3	38	T3-El2-E3-Sh3-Rc3
6	El2-Sh2-Rc3	17	T2-E3-Sh2-Rc3	28	T3	39	T3-El3
7	El3	18	T2-El2	29	T3-E3	40	T3-El3-E3
8	El3-E3-Sh2-Rc3	19	T2-El2-E3	30	T3-El3-Sh3-Rc2	41	T3-El3-E3-Sh2-Rc3
9	El3-Sh2-Rc2	20	T2-El2-E3-Rc2	31	T3-El3-Sh3-Rc3	42	T3-El3-E3-Sh3-Rc2
10	El3-Sh2-Rc3	21	T2-El2-E3-Sh2-Rc2	32	T3-El2	43	T3-El3-E3-Sh3-Rc3
11	Sh2	22	T2-El2-E3-Sh2-Rc3	33	T3-El2-E3		

CODE	LAND USE
2	Non-irrigated rice
4	Corn
81	Coffee
82	Cacao
105	Fruit trees, mixed
115	Mixed crops
116	Coconut
126	Grassland
134	Shrubland, unmanaged

SUITABILITY CLASSES:

Highly Suitable (S1)
Land having no significant limitation to sustained application of a given use, or only minor limitations that will not significantly reduce productivity or benefits and will not raise inputs above an acceptable level.

Moderately Suitable (S2)
Land having limitation which in aggregate are moderately severe for sustained application of a given use; the limitation will reduce productivity or benefits and increase required inputs to the extent that the overall advantage to be gained from the use, although still attractive, will be appreciably inferior to that expected on class S1 land,

Marginally Suitable (S3)
Land having limitations which in aggregate are severe for sustained application of a given use and will so reduce productivity or benefits, or increase required inputs, that this expenditure will be only marginally justified.

Not Suitable / Not Relevant
Land having limitations which may be surmountable in time but which cannot be corrected with existing knowledge at currently acceptable cost; the limitations are so severe as to preclude successful sustained use of the land in the given manner. Existing forest, shrubland greater than 18% slope, irrigated paddy rice and miscellaneous land types such as built up areas, roads, etc are considered as not relevant.

CLIMATE TYPE

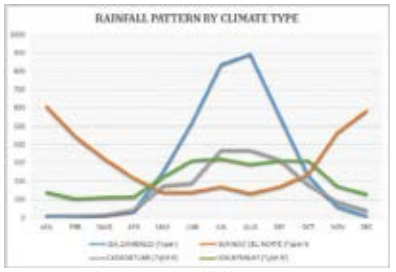
TYPE I : Two pronouced season, dry from November to April and wet during the rest of the year. Maximum rain period is from June to September

TYPE II : No dry season with a very pronounced maximum rain period from December to February. There is not a single dry month. Maximum monthly rainfall occurs during the period from March to May.

TYPE III : No very pronounced maximum rain period, with a dry season lasting only from one to three months, either during the period from December to February or from March to May. This type resembles Type I since it has a short dry season.

TYPE IV : Rainfall is more or less evenly distributed throughout the year, This type resembles Type II since it has no dry season.

Northeastern part of Kalinga mostly belongs to Type III climate classification and partly in the Western part belongs to Type I.



Source: PAGASA 2018, *Climatological Normals (Rainfall)*, Philippine Atmospheric, Geophysical and Astronomical Services Administration (PAGASA), accessed 27 July 2018, <https://www1.pagasa.dost.gov.ph/index.php/climate/climatological-normals>.

LAND SUITABILITY MAP FOR CACAO

LAND RESOURCES EVALUATION AND SUITABILITY ASSESSMENT OF STRATEGIC PRODUCTION AREAS

MOUNTAIN PROVINCE, CAR

EXTENT OF SUITABILITY FOR CACAO PRODUCTION BY MUNICIPALITY

MUNICIPALITY	EXISTING CACAO (Ha)			TOTAL EXISTING AREA (Ha)	EXPANSION AREA (Ha)						CONFLICT RESOLUTION (Ha)						TOTAL POTENTIAL EXPANSION AREA (Ha)
					Coconut		Shrubland, unmanaged*		Grassland, unmanaged*		Corn		Rice paddy, non-irrigated		Other crops		
	S1	S2	S3		S1	S2	S1	S2	S1	S2	S1	S2	S1	S2	S1	S2	
BARLIG	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BAUKO	-	-	-	-	-	-	-	39	-	74	-	212	-	1	-	-	325
BESAO	-	-	-	-	-	-	-	-	-	22	-	11	-	-	-	-	33
BONTOC	-	-	-	-	-	-	-	12	-	13	-	43	-	-	-	-	68
NATONIN	-	-	-	-	-	-	411	192	59	6	139	279	7	-	-	-	1,093
PARACELIS	4	-	11	15	385	286	3,284	53	4,235	78	6,097	99	2,050	49	-	-	16,617
SABANGAN	-	-	-	-	-	-	-	10	-	23	-	25	-	-	-	-	58
SADANGA	-	-	-	-	-	-	-	-	-	3	-	21	-	3	-	-	27
SAGADA	-	-	-	-	-	-	-	1	-	1	-	119	-	-	-	-	120
TADIAN	-	-	13	13	-	-	-	7	-	18	-	101	-	13	-	-	139
TOTAL	4	-	24	**28**	385	286	3,695	314	4,295	238	6,237	909	2,057	66	-	-	**18,480**

*establishment of shade trees prior to planting of cacao.

AGRONOMIC REQUIREMENT OF CACAO PRODUCTION

LAND UTILIZATION TYPE	SUITABILITY RATING	SLOPE (%)	SOIL DEPTH (cm)	SOIL TEXTURE	SOIL DRAINAGE	SOIL REACTION (pH)	INHERENT FERTILITY	FLOODING CLASS	EROSION CLASS	ROCK OUTCROPS	ELEVATION (masl)	ANNUAL RAINFALL (mm)	CLIMATIC TYPE
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	S2	8 - 30	50 - 100	FSL, L, SiL	SPD,PD	5.1 - 5.5 7.3 - 7.8	medium	moderate	moderate	common	1000-1500	1000-2000	I, II
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2	El2-E3-Rc3	12	El3-Sh2-Rc3	22	T2-El2-E3-Sh2-Rc3	32	T3-E3-Rc3	42	T3-El3
3	El2-E3-Sh2-Rc3	13	Sh2	23	T2-El3	33	T3-E3-Sh3-Rc2	43	T3-El3-E3
4	El2-Rc2	14	T2	24	T2-El3-E3	34	T3-E3-Sh3-Rc3	44	T3-El3-E3-Rc2
5	El2-Sh2-Rc2	15	T2-E3	25	T2-El3-E3-Rc2	35	T3-El2	45	T3-El3-E3-Rc3
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7	El3	17	T2-El2	27	T2-El3-E3-Sh2-Rc2	37	T3-El2-E3-Rc2	47	T3-El3-E3-Sh3-Rc2
8	El3-E3-Rc3	18	T2-El2-E3	28	T2-El3-E3-Sh2-Rc3	38	T3-El2-E3-Rc3	48	T3-El3-E3-Sh3-Rc3
9	El3-E3-Sh2-Rc3	19	T2-El2-E3-Rc2	29	T3	39	T3-El2-E3-Sh2-Rc3		
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SUITABILITY CLASSES:

Highly Suitable (S1)
Land having no significant limitation to sustained application of a given use, or only minor limitations that will not significantly reduce productivity or benefits and will not raise inputs above an acceptable level,

Moderately Suitable (S2)
Land having limitation which in aggregate are moderately severe for sustained application of a given use; the limitation will reduce productivity or benefits and increase required inputs to the extent that the overall advantage to be gained from the use, although still attractive, will be appreciably inferior to that expected on class S1 land,

Marginally Suitable (S3)
Land having limitations which in aggregate are severe for sustained application of a given use and will so reduce productivity or benefits, or increase required inputs, that this expenditure will be only marginally justified,

Not Suitable / Not Relevant
Land having limitations which may be surmountable in time but which cannot be corrected with existing knowledge at currently acceptable cost; the limitations are so severe as to preclude successful sustained use of the land in the given manner, Existing forest, shrubland greater than 18% slope, irrigated paddy rice and miscellaneous land types such as built up areas, roads, etc are considered as not relevant.

CLIMATE TYPE

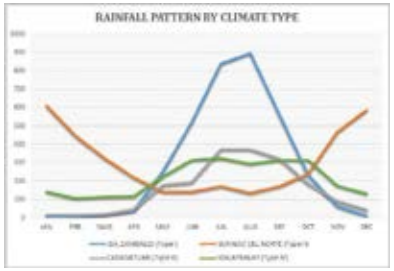
TYPE I : Two pronounced season, dry from November to April and wet during the rest of the year. Maximum rain period is from June to September

TYPE II : No dry season with a very pronounced maximum rain period from December to February. There is not a single dry month. Maximum monthly rainfall occurs during the period from March to May.

TYPE III : No very pronounced maximum rain period, with a dry season lasting only from one to three months, either during the period from December to February or from March to May. This type resembles Type I since it has a short dry season.

TYPE IV : Rainfall is more or less evenly distributed throughout the year, This type resembles Type II since it has no dry season.

Western part of Mountain Province belongs to Type I climate classification and the rest on Eastern part belongs to Type III.



Source: PAGASA 2018, *Climatological Normals (Rainfall)*, Philippine Atmospheric, Geophysical and Astronomical Services Administration (PAGASA), accessed 27 July 2018, <https://www1.pagasa.dost.gov.ph/index.php/climate/climatological-normals>.

LAND SUITABILITY MAP FOR CACAO

LAND RESOURCES EVALUATION AND SUITABILITY ASSESSMENT OF STRATEGIC PRODUCTION AREAS

NUEVA VIZCAYA, REGION II

EXTENT OF SUITABILITY FOR CACAO PRODUCTION BY MUNICIPALITY

MUNICIPALITY	EXISTING CACAO (Ha)			TOTAL EXISTING AREA (Ha)	EXPANSION AREA (Ha)						CONFLICT RESOLUTION (Ha)						TOTAL POTENTIAL EXPANSION AREA (Ha)
					Coconut		Shrubland, unmanaged*		Grassland, unmanaged*		Corn		Rice paddy, non-irrigated		Other crops		
	S1	S2	S3		S1	S2	S1	S2	S1	S2	S1	S2	S1	S2	S1	S2	
ALFONSO CASTANEDA	-	-	-	-	-	-	27	-	577	4	205	-	169	-	-	-	980
AMBAGUIO	-	-	-	-	-	-	-	-	9	26	-	11	-	-	-	-	47
ARITAO	41	-	-	41	52	-	118	-	1,445	51	958	109	766	3	-	-	3,502
BAGABAG	-	-	-	-	158	-	3	-	3,120	16	2,870	-	1,620	-	-	-	7,788
BAMBANG	28	-	159	187	88	10	-	-	2,426	53	1,451	439	1,460	15	-	-	5,941
BAYOMBONG	-	-	-	-	42	45	-	-	1,084	743	1,081	271	995	3	-	-	4,266
DIADI	-	-	17	17	527	-	477	-	2,739	34	2,713	5	678	-	-	-	7,174
DUPAX DEL NORTE	-	-	-	-	121	-	-	-	879	2,355	473	684	332	-	-	-	4,845
DUPAX DEL SUR	-	7	142	149	-	-	-	-	1,076	1,787	202	1	166	-	-	-	3,232
KASIBU	-	-	-	-	-	96	8	112	84	341	73	1,305	11	-	-	-	2,030
KAYAPA	-	-	-	-	8	8	-	-	123	19	84	7	3	2	-	-	253
QUEZON	-	-	-	-	-	-	-	-	2,970	27	855	-	364	-	-	-	4,216
SANTA FE	-	-	-	-	-	-	-	-	35	3	-	122	4	5	-	-	168
SOLANO	-	-	-	-	13	-	-	-	608	241	1,044	33	1,636	8	-	-	3,583
VILLAVERDE	-	-	-	-	16	13	-	15	324	545	966	214	1,234	18	-	-	3,345
TOTAL	69	7	317	**393**	1,026	172	633	127	17,500	6,246	12,975	3,201	9,437	53	-	-	**51,370**

Note: Delivery of cacao planting materials must be started on the onset of rainy season.
**establishment of shade trees prior to planting of cacao.*

SUITABILITY CLASSES:

Highly Suitable (S1)
Land having no significant limitation to sustained application of a given use, or only minor limitations that will not significantly reduce productivity or benefits and will not raise inputs above an acceptable level.

Moderately Suitable (S2)
Land having limitation which in aggregate are moderately severe for sustained application of a given use; the limitation will reduce productivity or benefits and increase required inputs to the extent that the overall advantage to be gained from the use, although still attractive, will be appreciably inferior to that expected on class S1 land.

Marginally Suitable (S3)
Land having limitations which in aggregate are severe for sustained application of a given use and will so reduce productivity or benefits, or increase required inputs, that this expenditure will be only marginally justified.

Not Suitable / Not Relevant
Land having limitations which may be surmountable in time but which cannot be corrected with existing knowledge at currently acceptable cost; the limitations are so severe as to preclude successful sustained use of the land in the given manner. Existing forest, shrubland greater than 18% slope, irrigated paddy rice and miscellaneous land types such as built up areas, roads, etc are considered as not relevant.

AGRONOMIC REQUIREMENT OF CACAO PRODUCTION

LAND UTILIZATION TYPE	SUITABILITY RATING	SLOPE (%)	SOIL DEPTH (cm)	SOIL TEXTURE	SOIL DRAINAGE	SOIL REACTION (pH)	INHERENT FERTILITY	FLOODING CLASS	EROSION CLASS	ROCK OUTCROPS	ELEVATION (masl)	ANNUAL RAINFALL (mm)	CLIMATIC TYPE
Cacao	S1	<8	>100	CL, SiCL, SCL, SC, SiC, C, HC	WD,MWD	5.6 - 7.2	high	none-slight	none-slight	none-few	<1000	2001-4500	I, III, IV
	S2	8 - 30	50 - 100	FSL, L, SiL	SPD,PD	5.1 - 5.5 7.3 - 7.8	medium	moderate	moderate	common	1000-1500	1000-2000	I, II
	S3	>30	<50	S, LS, CSL, SL	VPD,ED	<5.0 - > 7.9	low	severe	severe	many	>1500	<1000 >4500	

SLOPE (%)
0 - 3 - level to gently sloping
3 - 8 - gently sloping to undulating
8 - 18 - undulating to rolling
18 - 30 - rolling to moderately steep
30 - 50 - steep
> 50 - very steep

SOIL DEPTH (cm)
0 - 30 - very shallow
30 - 50 - shallow
50 - 100 - moderately deep
> 100 - deep to very deep

SOIL DRAINAGE
ED - excessively drained
WD - well drained
MWD - moderately well drained
SPD - somewhat poorly drained
PD - poorly drained
VPD - very poorly drained

SURFACE IMPEDIMENT
ROCK OUTCROPS
< 10% - none - few
10 - 30% - common
> 30% - many

SOIL REACTION (pH)
< 4,5 - extremely acid
4.5 - 5.0 - very strongly acid
5.1 - 5.5 - strongly acid
5.6 - 6.0 - medium acid
6.1 - 6.5 - slightly acid
6.6 - 7.2 - neutral
7.3 - 7.8 - mildly alkaline
7.9 - 8.4 - moderately alkaline
> 8.5 - strongly alkaline

SOIL TEXTURE
Coarse
S - sand
LS - loamy sand
CSL - coarse sandy loam
SL - sandy loam
Medium
FSL - fine sandy loam
L - loam
SiL - silt loam
CL - clay loam
SiCL - silty clay loam
SCL - sandy clay loam
Fine
SC - sandy clay
SiC - silty clay
C - clay
HC - heavy clay

CLIMATE TYPE

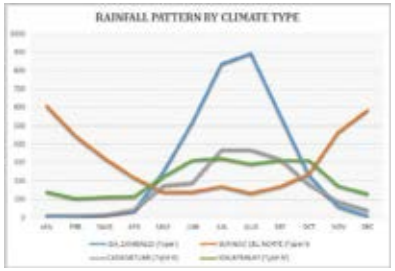
TYPE I : Two pronouced season, dry from November to April and wet during the rest of the year. Maximum rain period is from June to September

TYPE II : No dry season with a very pronounced maximum rain period from December to February. There is not a single dry month. Maximum monthly rainfall occurs during the period from March to May.

TYPE III : No very pronounced maximum rain period, with a dry season lasting only from one to three months, either during the period from December to February or from March to May. This type resembles Type I since it has a short dry season.

TYPE IV : Rainfall is more or less evenly distributed throughout the year. This type resembles Type II since it has no dry season.

Almost whole part of Nueva Vizcaya classified as climatic Type III and small part in the western side is Type I.



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LAND LIMITATIONS DESCRIPTION AND COMBINATIONS

ELEVATION
El2 - 1000m - 1500m
El3 - > 1500m

SLOPE/TOPOGRAPHY
T2 - Undulating to moderately steep
T3 - Steep to very steep

SOIL DRAINAGE
D2 - Somewhat poorly drained to poorly drained
D3 - Very poorly drained or excessively drained

SOIL TEXTURE
Tc - Coarse texture

SOIL DEPTH
Sh2 - Moderately deep (50 - 100cm)
Sh3 - Very shallow to shallow (< 50cm)

ROCK OUTCROPS
Rc2 - Common
Rc3 - Many

SOIL EROSION
E2 - Moderate erosion
E3 - Severe erosion

FLOODING
F2 - Moderate seasonal flooding
F3 - Severe seasonal flooding

CODE	LAND LIMITATION	CODE	LAND LIMITATION	CODE	LAND LIMITATION	CODE	LAND LIMITATION
1	E2-Sh2-Rc2	*11*	T2	*21*	T2-El3-E3	*31*	T3-El2-E3-Sh2-Rc3
2	El2	*12*	T2-E3	*22*	T2-El3-E3-Sh2-Rc3	*32*	T3-El2-E3-Sh3-Rc2
3	El2-E2-Sh2-Rc3	*13*	T2-E3-Rc2	*23*	T3	*33*	T3-El2-E3-Sh3-Rc3
4	El2-E3-Rc3	*14*	T2-E3-Sh2-Rc2	*24*	T3-E3	*34*	T3-El3-E3
5	El2-E3-Sh2-Rc3	*15*	T2-E3-Sh2-Rc3	*25*	T3-E3-Rc2	*35*	T3-El3-E3-Sh3-Rc3
6	El2-Sh2-Rc2	*16*	T2-El2	*26*	T3-E3-Rc3		
7	El2-Sh2-Rc3	*17*	T2-El2-E3	*27*	T3-E3-Sh3-Rc2		
8	El3	*18*	T2-El2-E3-Rc3	*28*	T3-E3-Sh3-Rc3		
9	El3-E3-Sh2-Rc3	*19*	T2-El2-E3-Sh2-Rc2	*29*	T3-El2		
10	Sh2-Rc2	*20*	T2-El2-E3-Sh2-Rc3	*30*	T3-El2-E3		

CODE	LAND USE
2	Rice paddy, non-irrigated
4	Corn
47	Vegetable
81	Coffee
82	Cacao
116	Coconut
126	Grassland
134	Shrubland, unmanaged

LAND SUITABILITY MAP FOR CACAO

LAND RESOURCES EVALUATION AND SUITABILITY ASSESSMENT OF STRATEGIC PRODUCTION AREAS

QUIRINO, REGION II

EXTENT OF SUITABILITY FOR CACAO PRODUCTION BY MUNICIPALITY

MUNICIPALITY	EXISTING CACAO (Ha)			TOTAL EXISTING AREA (Ha)	EXPANSION AREA (Ha)						CONFLICT RESOLUTION (Ha)						TOTAL POTENTIAL EXPANSION AREA (Ha)
					Coconut		Shrubland, unmanaged*		Grassland, unmanaged*		Corn		Rice paddy, non-irrigated		Other crops		
	S1	S2	S3		S1	S2	S1	S2	S1	S2	S1	S2	S1	S2	S1	S2	
AGLIPAY	8	-	-	8	626	-	1,276	8	1,410	59	6,911	203	1,919	36	-	-	12,448
CABARROGUIS	75	-	212	288	369	-	765	-	148	7	3,128	14	573	-	-	-	5,002
DIFFUN	62	11	235	308	44	-	110	8	635	24	5,964	649	2,128	90	-	-	9,651
MADDELA	34	6	293	333	2,218	211	561	50	883	83	5,673	169	1,907	3	-	-	11,757
NAGTIPUNAN	-	-	1	1	85	6	171	*4	675	548	1,531	176	276	4	-	-	3,546
SAGUDAY	-	-	-	-	9	3	32	-	-	-	1,711	313	1,131	248	-	-	3,447
TOTAL	179	17	742	938	3,351	220	2,915	140	3,750	721	24,917	1,524	7,933	380	-	-	45,851

*establishment of shade trees prior to planting of cacao.

AGRONOMIC REQUIREMENT OF CACAO PRODUCTION

LAND UTILIZATION TYPE	SUITABILITY RATING	SLOPE (%)	SOIL DEPTH (cm)	SOIL TEXTURE	SOIL DRAINAGE	SOIL REACTION (pH)	INHERENT FERTILITY	FLOODING CLASS	EROSION CLASS	ROCK OUTCROPS	ELEVATION (masl)	ANNUAL RAINFALL (mm)	CLIMATIC TYPE
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2	El2	12	T2	22	T2-El2-E3-Sh2-Rc3	32	T3-El2-E3
3	El2-E2-Sh2-Rc3	13	T2-E3	23	T2-El3	33	T3-El2-E3-Rc2
4	El2-E3-Sh2-Rc3	14	T2-E3-Rc2	24	T2-El3-E3-Sh2-Rc2	34	T3-El2-E3-Rc3
5	El2-Rc2	15	T2-E3-Sh2-Rc2	25	T3	35	T3-El2-E3-Sh2-Rc2
6	El2-Sh2-Rc2	16	T2-E3-Sh2-Rc3	26	T3-E3	36	T3-El2-E3-Sh3-Rc3
7	El2-Sh2-Rc3	17	T2-El2	27	T3-E3-Rc2	37	T3-El3
8	El3	18	T2-El2-E3	28	T3-E3-Rc3	38	T3-El3-E3-Sh3-Rc2
9	El3-Sh2-Rc2	19	T2-El2-E3-Rc2	29	T3-E3-Sh3-Rc2	39	T3-El3-E3-Sh3-Rc3
10	Sh2	20	T2-El2-E3-Rc3	30	T3-E3-Sh3-Rc3		

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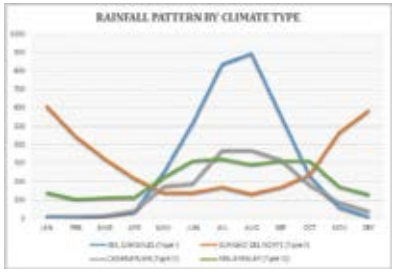
TYPE IV : Rainfall is more or less evenly distributed throughout the year. This type resembles Type II since it has no dry season.

The whole part of Quirino classified as climatic Type III.



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LAND SUITABILITY MAP FOR CACAO

LAND RESOURCES EVALUATION AND SUITABILITY ASSESSMENT OF STRATEGIC PRODUCTION AREAS

BATANGAS, REGION IV-A

EXTENT OF SUITABILITY FOR CACAO PRODUCTION BY MUNICIPALITY

MUNICIPALITY	EXISTING CACAO (Ha)			TOTAL EXISTING AREA (Ha)	EXPANSION AREA (Ha)						CONFLICT RESOLUTION (Ha)								TOTAL POTENTIAL EXPANSION AREA (Ha)
					Coconut		Shrubland, unmanaged*		Grassland, unmanaged*		Corn		Rice paddy, non-irrigated		Sugarcane		Other Crops		
	S1	S2	S3		S1	S2	S1	S2	S1	S2	S1	S2	S1	S2	S1	S2	S1	S2	
AGONCILLO	-	-	-	-	-	-	-	-	-	-	21	-	46	-	259	-	2,151	-	2,477
ALITAGTAG	-	-	-	-	536	186	-	9	-	-	261	10	330	-	-	-	-	-	1,332
BALAYAN	-	-	-	-	292	20	31	-	-	-	1,854	659	3,579	71	501	-	-	1	7,008
BALETE	-	-	-	-	301	1,035	-	1	61	7	52	19	64	1	-	-	52	7	1,598
BATANGAS CITY	-	-	-	-	9,548	562	105	144	54	25	879	196	425	10	-	-	33	-	11,983
BAUAN	-	-	-	-	2,207	77	151	-	31	-	99	-	224	-	-	-	22	-	2,811
CALACA	-	-	-	-	43	120	-	-	-	-	2,025	570	1,197	202	353	1,580	783	2,271	9,143
CALATAGAN	-	-	-	-	2,376	491	107	72	96	249	1,194	86	2,297	118	37	-	11	17	7,152
CITY OF TANAUAN	-	-	-	-	1,239	1,063	-	-	-	-	796	5	2,721	13	1,668	15	809	145	8,473
CUENCA	-	-	-	-	732	311	1	22	-	-	126	-	7	-	-	-	-	-	1,198
IBAAN	-	-	-	-	2,370	58	-	-	-	-	3,085	40	349	1	-	-	-	-	5,904
LAUREL	-	-	-	-	370	6	3	-	-	2	188	-	51	-	33	-	1,766	-	2,419
LEMERY	-	-	-	-	-	-	-	-	-	-	524	-	266	92	102	412	1,522	1,677	4,595
LIAN	-	-	-	-	876	-	167	6	159	-	2,266	43	1,807	8	99	-	117	-	5,549
LIPA CITY	-	-	-	-	7,750	462	20	-	82	-	3,125	3	678	-	-	-	-	-	12,118
LOBO	-	-	-	-	1,410	646	655	315	408	-	194	64	77	8	-	-	-	-	3,849
MABINI	-	-	-	-	824	-	26	-	18	-	-	-	-	-	-	-	-	-	868
MALVAR	-	-	-	-	529	385	-	-	-	-	1,557	61	293	-	-	-	-	-	2,826
MATAASNAKAHOY	-	-	-	-	184	709	-	-	-	-	26	-	22	-	-	-	-	36	978
NASUGBU	-	-	-	-	2,549	1,244	390	69	170	-	2,472	713	3,706	520	63	-	-	-	11,895
PADRE GARCIA	-	-	-	-	1,321	-	-	-	-	-	1,812	-	373	-	-	-	-	-	3,506
ROSARIO	-	-	-	-	6,671	66	506	-	80	-	7,433	136	2,089	2	-	-	-	-	16,983
SAN JOSE	-	-	-	-	3,558	145	-	-	-	-	291	-	86	-	-	-	-	-	4,079
SAN JUAN	-	-	-	-	4,920	1,911	381	173	3	2	5,634	351	2,347	40	-	-	-	-	15,760
SAN LUIS	-	-	-	-	343	120	-	-	-	-	1,762	407	114	-	-	-	-	-	2,746
SAN NICOLAS	-	-	-	-	-	-	7	-	635	-	14	-	237	-	491	-	169	-	1,553
SAN PASCUAL	-	-	-	-	1,721	20	-	-	-	-	63	-	269	9	-	-	-	-	2,082
SANTA TERESITA	-	-	-	-	77	123	-	-	-	-	783	50	55	-	179	-	30	-	1,297
SANTO TOMAS	-	-	-	-	3,514	46	7	-	175	-	1,508	7	589	8	-	-	-	-	5,854
TAAL	-	-	-	-	2	2	-	-	-	-	1,090	78	245	4	801	1	77	-	2,301
TALISAY	-	-	-	-	305	-	168	1	438	4	38	-	57	-	29	-	904	-	1,944
TAYSAN	-	-	-	-	4,080	-	-	-	62	-	2,281	51	309	-	-	-	-	-	6,782
TINGLOY	-	-	-	-	276	-	5	-	32	-	104	-	-	-	-	-	-	-	417
TUY	-	-	-	-	8	57	39	21	-	14	2,995	2,368	1,802	495	77	-	-	-	7,876
TOTAL	-	-	-	-	60,932	9,863	2,768	833	2,574	303	46,551	5,918	26,711	1,602	4,693	2,008	8,444	4,153	177,355

Note: Delivery of cacao planting materials must be started on the onset of rainy season.
**establishment of shade trees prior to planting of cacao.*

AGRONOMIC REQUIREMENT OF CACAO PRODUCTION

LAND UTILIZATION TYPE	SUITABILITY RATING	SLOPE (%)	SOIL DEPTH (cm)	SOIL TEXTURE	SOIL DRAINAGE	SOIL REACTION (pH)	INHERENT FERTILITY	FLOODING CLASS	EROSION CLASS	ROCK OUTCROPS	ELEVATION (masl)	ANNUAL RAINFALL (mm)	CLIMATIC TYPE
Cacao	S1	<8	>100	CL, SiCL, SCL, SC, SiC, C, HC	WD,MWD	5.6 -7.2	high	none-slight	none-slight	none-few	<1000	2001-4500	I, III, IV
	S2	8 - 30	50 - 100	FSL, L, SiL	SPD,PD	5.1 - 5.5 7.3 - 7.8	medium	moderate	moderate	common	1000-1500	1000-2000	I, II
	S3	>30	<50	S, LS, CSL, SL	VPD,ED	<5.0 - > 7.9	low	severe	severe	many	>1500	<1000 >4500	

SLOPE (%)
0 - 3 - level to gently sloping
3 - 8 - gently sloping to undulating
8 - 18 - undulating to rolling
18 - 30 - rolling to moderately steep
30 - 50 - steep
> 50 - very steep

SOIL DEPTH (cm)
0 - 30 - very shallow
30 - 50 - shallow
50 - 100 - moderately deep
> 100 - deep to very deep

SOIL DRAINAGE
ED - excessively drained
WD - well drained
MWD - moderately well drained
SPD - somewhat poorly drained
PD - poorly drained
VPD - very poorly drained

SURFACE IMPEDIMENT
ROCK OUTCROPS
< 10% - none - few
10 - 30% - common
> 30% - many

SOIL REACTION (pH)
< 4.5 - extremely acid
4.5 - 5.0 - very strongly acid
5.1 - 5.5 - strongly acid
5.6 - 6.0 - medium acid
6.1 - 6.5 - slightly acid
6.6 - 7.2 - neutral
7.3 - 7.8 - mildly alkaline
7.9 - 8.4 - moderately alkaline
> 8.5 - strongly alkaline

SOIL TEXTURE
Coarse
S - sand
LS - loamy sand
CSL - coarse sandy loam
SL - sandy loam
Medium
FSL - fine sandy loam
L - loam
SiL - silt loam
CL - clay loam
SiCL - silty clay loam
SCL - sandy clay loam
Fine
SC - sandy clay
SiC - silty clay
C - clay
HC - heavy clay

LAND LIMITATIONS DESCRIPTION AND COMBINATIONS

ELEVATION
EI2 - 1000m - 1500m
EI3 - > 1500m

SLOPE/TOPOGRAPHY
T2 - Undulating to moderately steep
T3 - Steep to very steep

SOIL DRAINAGE
D2 - Somewhat poorly drained to poorly drained
D3 - Very poorly drained or excessively drained

SOIL TEXTURE
Tc - Coarse texture

SOIL DEPTH
Sh2 - Moderately deep (50 - 100cm)
Sh3 - Very shallow to shallow (< 50cm)

ROCK OUTCROPS
Rc2 - Common
Rc3 - Many

SOIL EROSION
E2 - Moderate erosion
E3 - Severe erosion

FLOODING
F2 - Moderate seasonal flooding
F3 - Severe seasonal flooding

SUITABILITY CLASSES:

Highly Suitable (S1)
Land having no significant limitation to sustained application of a given use, or only minor limitations that will not significantly reduce productivity or benefits and will not raise inputs above an acceptable level.

Moderately Suitable (S2)
Land having limitation which in aggregate are moderately severe for sustained application of a given use; the limitation will reduce productivity or benefits and increase required inputs to the extent that the overall advantage to be gained from the use, although still attractive, will be appreciably inferior to that expected on class S1 land,

Marginally Suitable (S3)
Land having limitations which in aggregate are severe for sustained application of a given use and will so reduce productivity or benefits, or increase required inputs, that this expenditure will be only marginally justified.

Not Suitable / Not Relevant
Land having limitations which may be surmountable in time but which cannot be corrected with existing knowledge at currently acceptable cost; the limitations are so severe as to preclude successful sustained use of the land in the given manner, Existing forest, shrubland greater than 18% slope, irrigated paddy rice and miscellaneous land types such as built up areas, roads, etc are considered as not relevant.

CLIMATE TYPE

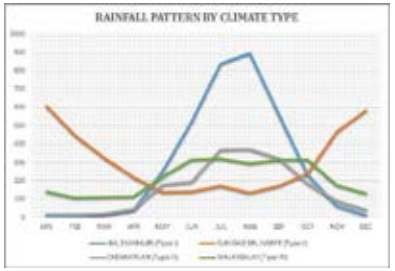
TYPE I : Two pronouced season, dry from November to April and wet during the rest of the year, Maximum rain period is from June to September

TYPE II : No dry season with a very pronounced maximum rain period from December to February, There is not a single dry month, Maximum monthly rainfall occurs during the period from March to May.

TYPE III : No very pronounced maximum rain period, with a dry season lasting only from one to three months, either during the period from December to February or from March to May, This type resembles Type I since it has a short dry season.

TYPE IV : Rainfall is more or less evenly distributed throughout the year, This type resembles Type II since it has no dry season.

Western part of Batangas belongs to Type I climate classification and the rest on Eastern part belongs to Type III.



Source: PAGASA 2018, *Climatological Normals (Rainfall)*, Philippine Atmospheric, Geophysical and Astronomical Services Administration (PAGASA), accessed 27 July 2018, <https://www1.pagasa.dost.gov.ph/index.php/climate/climatological-normals>.

CODE	LAND LIMITATION	CODE	LAND LIMITATION	CODE	LAND LIMITATION
1	E2-Sh2-Rc2	11	T2-E3-Rc3	21	T3-E3-Sh2-Rc3
2	EI2	12	T2-E3-Sh2-Rc2	22	T3-E3-Sh3-Rc2
3	EI2-Sh2-Rc2	13	T2-E3-Sh2-Rc3	23	T3-E3-Sh3-Rc3
4	EI2-Sh2-Rc3	14	T2-EI2	24	T3-EI2
5	F2-D2	15	T2-EI2-E3-Sh2-Rc2	25	T3-EI2-E3-Sh3-Rc2
6	F3-D2	16	T2-EI2-E3-Sh2-Rc3	26	T3-EI2-E3-Sh3-Rc3
7	Sh2-Rc2	17	T2-F2-D2	27	Tc
8	T2	18	T2-F3-D2		
9	T2-E3	19	T3		
10	T2-E3-Rc2	20	T3-E3		

CODE	LAND USE
2	Rice paddy, non-irrigated
4	Corn
34	Diversified crops
81	Coffee
112	Sugarcane
116	Coconut
126	Grassland
134	Shrubs, unmanaged

LAND SUITABILITY MAP FOR CACAO

LAND RESOURCES EVALUATION AND SUITABILITY ASSESSMENT OF STRATEGIC PRODUCTION AREAS

CAVITE, REGION IV-A

EXTENT OF SUITABILITY FOR CACAO PRODUCTION BY MUNICIPALITY

MUNICIPALITY	EXISTING CACAO (Ha)			TOTAL EXISTING AREA (Ha)	EXPANSION AREA (Ha)						CONFLICT RESOLUTION (Ha)						TOTAL POTENTIAL EXPANSION AREA (Ha)
					Coconut		Shrubland, unmanaged*		Grassland, unmanaged*		Corn		Rice paddy, non-irrigated		Other Crops		
	S1	S2	S3		S1	S2	S1	S2	S1	S2	S1	S2	S1	S2	S1	S2	
ALFONSO	-	-	-	-	2,953	839	252	-	-	137	1,116	514	-	3	-	-	5,814
AMADEO	-	-	-	-	2,043	404	25	-	-	-	376	193	-	-	-	-	3,041
BACOOR CITY	-	-	-	-	14	-	2	-	269	-	54	-	612	-	-	-	950
CARMONA	-	-	-	-	-	-	484	-	134	1	138	-	139	-	-	-	895
CAVITE CITY	-	-	-	-	-	-	124	-	68	-	-	-	-	-	-	-	192
CITY OF DASMARIÑAS	-	-	-	-	486	-	117	-	468	-	2,757	5	1,221	-	-	-	5,054
CITY OF GENERAL TRIAS	-	-	-	-	54	-	37	-	150	-	911	-	1,683	-	-	-	2,835
GEN. MARIANO ALVAREZ	-	-	-	-	124	-	22	-	88	-	1	-	24	-	-	-	259
GENERAL EMILIO AGUINALDO	-	-	-	-	2,724	46	573	-	-	-	360	2	-	-	-	-	3,704
IMUS CITY	-	-	-	-	-	-	-	-	28	-	883	-	823	-	-	-	1,734
INDANG	-	-	-	-	6,285	264	263	-	80	-	1,056	37	14	-	-	-	7,998
KAWIT	-	-	-	-	-	-	-	-	-	-	81	-	276	-	-	-	357
MAGALLANES	16	-	122	138	3,222	106	40	-	137	-	1,690	40	5	-	-	-	5,241
MARAGONDON	25	-	23	48	1,361	-	1,260	-	1,312	-	2,043	1	601	-	-	-	6,578
MENDEZ	-	-	-	-	417	680	-	-	-	-	1	47	-	-	-	-	1,145
NAIC	-	-	-	-	808	-	44	-	544	-	2,060	-	1,719	-	-	-	5,176
NOVELETA	-	-	-	-	-	-	-	-	-	-	2	-	4	-	-	-	6
ROSARIO	-	-	-	-	-	-	-	-	-	-	14	-	-	-	-	-	14
SILANG	-	-	-	-	2,615	201	950	1	291	-	5,342	188	426	-	-	-	10,012
TAGAYTAY CITY	-	-	-	-	86	935	-	-	9	6	12	422	-	-	-	-	1,470
TANZA	-	-	-	-	75	-	-	-	588	-	902	-	2,858	-	-	-	4,422
TERNATE	-	-	-	-	-	-	580	-	6	-	139	-	203	-	-	-	928
TRECE MARTIRES CITY	-	-	-	-	735	-	110	-	1,039	-	276	-	718	-	-	-	2,877
TOTAL	42	-	145	186	24,003	3,474	4,882	1	5,211	144	20,211	1,449	11,326	3	-	-	**70,703**

Note: Delivery of cacao planting materials must be started on the onset of rainy season.
**establishment of shade trees prior to planting of cacao.*

SUITABILITY CLASSES:

Highly Suitable (S1)
Land having no significant limitation to sustained application of a given use, or only minor limitations that will not significantly reduce productivity or benefits and will not raise inputs above an acceptable level.

Marginally Suitable (S3)
Land having limitations which in aggregate are severe for sustained application of a given use and will so reduce productivity or benefits, or increase required inputs, that this expenditure will be only marginally justified.

Moderately Suitable (S2)
Land having limitation which in aggregate are moderately severe for sustained application of a given use; the limitation will reduce productivity or benefits and increase required inputs to the extent that the overall advantage to be gained from the use, although still attractive, will be appreciably inferior to that expected on class S1 land.

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Land having limitations which may be surmountable in time but which cannot be corrected with existing knowledge at currently acceptable cost; the limitations are so severe as to preclude successful sustained use of the land in the given manner. Existing forest, shrubland greater than 18% slope, irrigated paddy rice and miscellaneous land types such as built up areas, roads, etc are considered as not relevant.

AGRONOMIC REQUIREMENT OF CACAO PRODUCTION

LAND UTILIZATION TYPE	SUITABILITY RATING	SLOPE (%)	SOIL DEPTH (cm)	SOIL TEXTURE	SOIL DRAINAGE	SOIL REACTION (pH)	INHERENT FERTILITY	FLOODING CLASS	EROSION CLASS	ROCK OUTCROPS	ELEVATION (masl)	ANNUAL RAINFALL (mm)	CLIMATIC TYPE
Cacao	S1	<8	>100	Cl., SiCl., SCl., SC, SiC, C, HC	WD,MWD	5,6 -7,2	high	none-slight	none-slight	none-few	<1000	2001-4500	I, III, IV
	S2	8 - 30	50 - 100	FSL, L, SiL	SPD,PD	5,1 - 5,5 7,3 - 7,8	medium	moderate	moderate	common	1000-1500	1000-2000	I, II
	S3	>30	<50	S, LS, CSL, SL	VPD,ED	<5,0 - > 7,9	low	severe	severe	many	>1500	<1000 >4500	

SLOPE (%)
0 - 3 - level to gently sloping
3 - 8 - gently sloping to undulating
8 - 18 - undulating to rolling
18 - 30 - rolling to moderately steep
30 - 50 - steep
> 50 - very steep

SOIL DEPTH (cm)
0 - 30 - very shallow
30 - 50 - shallow
50 - 100 - moderately deep
> 100 - deep to very deep

SOIL DRAINAGE
ED - excessively drained
WD - well drained
MWD - moderately well drained
SPD - somewhat poorly drained
PD - poorly drained
VPD - very poorly drained

SURFACE IMPEDIMENT
ROCK OUTCROPS
< 10% - none - few
10 - 30% - common
> 30% - many

SOIL REACTION (pH)
< 4.5 - extremely acid
4.5 - 5.0 - very strongly acid
5.1 - 5.5 - strongly acid
5.6 - 6.0 - medium acid
6.1 - 6.5 - slightly acid
6.6 - 7.2 - neutral
7.3 - 7.8 - mildly alkaline
7.9 - 8.4 - moderately alkaline
> 8.5 - strongly alkaline

SOIL TEXTURE
Coarse
S - sand
LS - loamy sand
CSL - coarse sandy loam
SL - sandy loam
Medium
FSL - fine sandy loam
L - loam
SiL - silt loam
CL - clay loam
SiCL - silty clay loam
SCL - sandy clay loam
Fine
SC - sandy clay
SiC - silty clay
C - clay
HC - heavy clay

LAND LIMITATIONS DESCRIPTION AND COMBINATIONS

ELEVATION
EI2 - 1000m - 1500m
EI3 - > 1500m

SLOPE/TOPOGRAPHY
T2 - Undulating to moderately steep
T3 - Steep to very steep

SOIL DRAINAGE
D2 - Somewhat poorly drained to poorly drained
D3 - Very poorly drained or excessively drained

SOIL TEXTURE
Tc - Coarse texture

SOIL DEPTH
Sh2 - Moderately deep (50 - 100cm)
Sh3 - Very shallow to shallow (< 50cm)

ROCK OUTCROPS
Rc2 - Common
Rc3 - Many

SOIL EROSION
E2 - Moderate erosion
E3 - Severe erosion

FLOODING
F2 - Moderate seasonal flooding
F3 - Severe seasonal flooding

CODE	LAND LIMITATION	CODE	LAND LIMITATION	CODE	LAND LIMITATION
1	E2-Sh2-Rc2	11	T2-E3-Sh2-Rc2	21	T3-EI2
2	EI2	12	T2-E3-Sh2-Rc3	22	T3-EI2-E3-Sh3-Rc2
3	EI2-E2-Sh2-Rc3	13	T2-EI2	23	T3-EI2-E3-Sh3-Rc3
4	EI2-E3-Sh2-Rc3	14	T2-EI2-E3-Sh2-Rc2		
5	EI2-Rc2	15	T2-EI2-E3-Sh2-Rc3		
6	EI2-Sh2-Rc2	16	T2-F3-D2		
7	F2-D2	17	T3		
8	F3-D2	18	T3-E3		
9	T2	19	T3-E3-Sh3-Rc2		
10	T2-E3	20	T3-E3-Sh3-Rc3		

CODE	LAND USE
2	Rice paddy, non-irrigated
4	Corn
34	Diversified crops
82	Cacao
116	Coconut
126	Grassland
134	Shrubland, unmanaged

CLIMATE TYPE

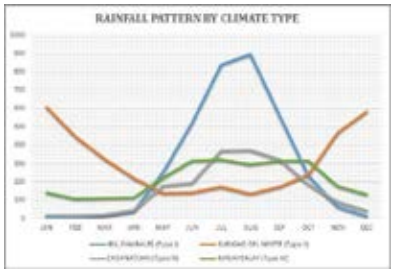
TYPE I : Two pronouced season, dry from November to April and wet during the rest of the year. Maximum rain period is from June to September

TYPE II : No dry season with a very pronounced maximum rain period from December to February. There is not a single dry month. Maximum monthly rainfall occurs during the period from March to May.

TYPE III : No very pronounced maximum rain period, with a dry season lasting only from one to three months, either during the period from December to February or from March to May. This type resembles Type I since it has a short dry season.

TYPE IV : Rainfall is more or less evenly distributed throughout the year. This type resembles Type II since it has no dry season.

The whole part of Cavite classified as climatic Type I.



Source: PAGASA 2018, *Climatological Normals (Rainfall)*, Philippine Atmospheric, Geophysical and Astronomical Services Administration (PAGASA), accessed 27 July 2018, <https://www1.pagasa.dost.gov.ph/index.php/climate/climatological-normals>.

LAND SUITABILITY MAP FOR CACAO

LAND RESOURCES EVALUATION AND SUITABILITY ASSESSMENT OF STRATEGIC PRODUCTION AREAS

LAGUNA, REGION IV-A

EXTENT OF SUITABILITY FOR CACAO PRODUCTION BY MUNICIPALITY

MUNICIPALITY	EXISTING CACAO (Ha)			TOTAL EXISTING AREA (Ha)	EXPANSION AREA (Ha)						CONFLICT RESOLUTION (Ha)								TOTAL POTENTIAL EXPANSION AREA (Ha)
					Coconut		Shrubland, unmanaged*		Grassland, unmanaged*		Corn		Rice paddy, non-irrigated		Sugarcane		Other crops		
	S1	S2	S3		S1	S2	S1	S2	S1	S2	S1	S2	S1	S2	S1	S2	S1	S2	
ALAMINOS	-	-	-	-	801	-	2,364	22	476	-	39	-	12	-	-	-	-	-	3,714
BAY	-	-	-	-	346	2	286	-	148	-	699	-	242	-	-	-	-	-	1,723
CABUYAO CITY	-	-	-	-	355	9	3	1	223	-	389	-	438	-	-	-	-	-	1,418
CALAUAN	-	-	-	-	1,866	-	276	-	623	-	1,218	-	246	-	-	-	-	-	4,230
CAVINTI	104	-	7	110	1,227	-	6,090	20	168	5	335	-	135	-	-	-	-	-	7,980
CITY OF BIÑAN	-	-	-	-	-	-	35	-	222	-	356	-	253	-	-	-	-	-	866
CITY OF CALAMBA	-	-	-	-	724	-	814	7	1,076	-	1,856	2	1,511	11	217	15	-	-	6,231
CITY OF SAN PEDRO	-	-	-	-	15	-	26	-	68	-	-	-	3	-	-	-	-	-	111
CITY OF SANTA ROSA	-	-	-	-	-	-	-	-	499	-	215	-	734	-	-	-	-	-	1,449
FAMY	-	-	-	-	235	-	536	-	49	-	219	-	27	-	-	-	-	-	1,067
KALAYAAN	15	-	-	15	1,038	-	1,916	-	205	-	378	-	232	-	-	-	-	-	3,769
LILIW	-	-	-	-	433	-	1,767	104	27	-	385	-	31	-	-	-	-	-	2,748
LOS BAÑOS	-	-	-	-	184	-	423	-	64	-	468	-	52	-	-	-	-	-	1,191
LUISIANA	-	-	-	-	107	-	4,514	-	190	-	003	-	163	-	-	-	-	-	4,974
LUMBAN	-	-	-	-	1,068	-	2,073	-	973	-	548	-	309	-	-	-	-	-	4,972
MABITAC	-	-	-	-	311	-	248	-	157	-	349	-	302	-	-	-	-	-	1,367
MAGDALENA	-	-	-	-	350	-	297	-	282	-	1,546	-	183	-	-	-	-	-	2,659
MAJAYJAY	-	-	-	-	842	43	1,174	201	50	20	660	180	45	9	-	-	-	-	3,224
NAGCARLAN	-	-	-	-	824	-	2,845	85	12	-	348	24	38	-	-	-	-	-	4,175
PAETE	-	-	-	-	289	-	1,515	65	83	-	23	-	49	-	-	-	-	-	2,023
PAGSANJAN	-	-	-	-	290	-	201	-	41	-	735	-	121	-	-	-	-	-	1,388
PAKIL	-	-	-	-	66	-	164	-	419	-	424	-	131	-	-	-	-	-	1,204
PANGIL	5	-	-	5	58	-	301	-	561	11	113	-	121	-	-	-	-	-	1,165
PILA	-	-	-	-	71	-	-	-	-	-	436	-	85	-	-	-	-	-	591
RIZAL	-	-	-	-	2	-	1,051	60	16	12	129	28	13	-	-	-	-	-	1,312
SAN PABLO CITY	-	-	-	-	1,160	4	9,798	447	182	33	872	-	367	2	-	-	-	-	12,865
SANTA CRUZ	-	-	-	-	85	-	-	-	24	-	718	-	241	-	-	-	-	-	1,069
SANTA MARIA	-	-	-	-	472	-	1,089	-	878	5	369	-	130	-	-	-	-	-	2,943
SINILOAN	-	-	-	-	352	-	634	-	215	-	151	-	68	-	-	-	-	-	1,420
VICTORIA	-	-	-	-	-	-	-	-	-	-	200	-	125	-	-	-	-	-	326
TOTAL	124	-	7	131	13,570	58	40,440	1,011	7,933	86	14,180	235	6,408	22	217	15	-	-	84,175

Note: Delivery of cacao planting materials must be started on the onset of rainy season.
**establishment of shade trees prior to planting of cacao.*

AGRONOMIC REQUIREMENT OF CACAO PRODUCTION

LAND UTILIZATION TYPE	SUITABILITY RATING	SLOPE (%)	SOIL DEPTH (cm)	SOIL TEXTURE	SOIL DRAINAGE	SOIL REACTION (pH)	INHERENT FERTILITY	FLOODING CLASS	EROSION CLASS	ROCK OUTCROPS	ELEVATION (masl)	ANNUAL RAINFALL (mm)	CLIMATIC TYPE
Cacao	S1	<8	>100	CL, SiCL, SCL, SC, SiC, C, HC	WD,MWD	5.6 -7.2	high	none-slight	none-slight	none-few	<1000	2001-4500	I, III, IV
	S2	8 - 30	50 - 100	FSL, L, SiL	SPD,PD	5.1 - 5.5 7.3 - 7.8	medium	moderate	moderate	common	1000-1500	1000-2000	I, II
	S3	>30	<50	S, LS, CSL, SL	VPD,ED	<5.0 - > 7.9	low	severe	severe	many	>1500	<1000 >4500	

SLOPE (%)
0 - 3 - level to gently sloping
3 - 8 - gently sloping to undulating
8 - 18 - undulating to rolling
18 - 30 - rolling to moderately steep
30 - 50 - steep
> 50 - very steep

SOIL DEPTH (cm)
0 - 30 - very shallow
30 - 50 - shallow
50 - 100 - moderately deep
> 100 - deep to very deep

SOIL DRAINAGE
ED - excessively drained
WD - well drained
MWD - moderately well drained
SPD - somewhat poorly drained
PD - poorly drained
VPD - very poorly drained

SURFACE IMPEDIMENT
ROCK OUTCROPS
< 10% - none - few
10 - 30% - common
> 30% - many

SOIL REACTION (pH)
< 4.5 - extremely acid
4.5 - 5.0 - very strongly acid
5.1 - 5.5 - strongly acid
5.6 - 6.0 - medium acid
6.1 - 6.5 - slightly acid
6.6 - 7.2 - neutral
7.3 - 7.8 - mildly alkaline
7.9 - 8.4 - moderately alkaline
> 8.5 - strongly alkaline

SOIL TEXTURE
Coarse
S - sand
LS - loamy sand
CSL - coarse sandy loam
SL - sandy loam
Medium
FSL - fine sandy loam
L - loam
SiL - silt loam
CL - clay loam
SiCL - silty clay loam
SCL - sandy clay loam
Fine
SC - sandy clay
SiC - silty clay
C - clay
HC - heavy clay

LAND LIMITATIONS DESCRIPTION AND COMBINATIONS

ELEVATION
El2 - 1000m - 1500m
El3 - > 1500m

SLOPE/TOPOGRAPHY
T2 - Undulating to moderately steep
T3 - Steep to very steep

SOIL DRAINAGE
D2 - Somewhat poorly drained to poorly drained
D3 - Very poorly drained or excessively drained

SOIL TEXTURE
Tc - Coarse texture

SOIL DEPTH
Sh2 - Moderately deep (50 - 100cm)
Sh3 - Very shallow to shallow (< 50cm)

ROCK OUTCROPS
Rc2 - Common
Rc3 - Many

SOIL EROSION
E2 - Moderate erosion
E3 - Severe erosion

FLOODING
F2 - Moderate seasonal flooding
F3 - Severe seasonal flooding

SUITABILITY CLASSES:

Highly Suitable (S1)
Land having no significant limitation to sustained application of a given use, or only minor limitations that will not significantly reduce productivity or benefits and will not raise inputs above an acceptable level.

Moderately Suitable (S2)
Land having limitation which in aggregate are moderately severe for sustained application of a given use; the limitation will reduce productivity or benefits and increase required inputs to the extent that the overall advantage to be gained from the use, although still attractive, will be appreciably inferior to that expected on class S1 land.

Marginally Suitable (S3)
Land having limitations which in aggregate are severe for sustained application of a given use and will so reduce productivity or benefits, or increase required inputs, that this expenditure will be only marginally justified.

Not Suitable / Not Relevant
Land having limitations which may be surmountable in time but which cannot be corrected with existing knowledge at currently acceptable cost; the limitations are so severe as to preclude successful sustained use of the land in the given manner. Existing forest, shrubland greater than 18% slope, irrigated paddy rice and miscellaneous land types such as built up areas, roads, etc are considered as not relevant.

CLIMATE TYPE

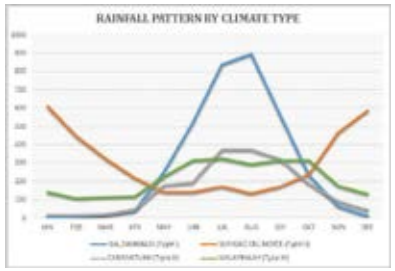
TYPE I : Two pronounced season, dry from November to April and wet during the rest of the year. Maximum rain period is from June to September

TYPE II : No dry season with a very pronounced maximum rain period from December to February. There is not a single dry month. Maximum monthly rainfall occurs during the period from March to May.

TYPE III : No very pronounced maximum rain period, with a dry season lasting only from one to three months, either during the period from December to February or from March to May. This type resembles Type I since it has a short dry season.

TYPE IV : Rainfall is more or less evenly distributed throughout the year. This type resembles Type II since it has no dry season.

Western part of Laguna lies on climatic Type I and eastern part is Type III.



Source: PAGASA 2018, *Climatological Normals (Rainfall)*, Philippine Atmospheric, Geophysical and Astronomical Services Administration (PAGASA), accessed 27 July 2018, <https://www1.pagasa.dost.gov.ph/index.php/climate/climatological-normals>.

CODE	LAND LIMITATION	CODE	LAND LIMITATION	CODE	LAND LIMITATION
1	El2-Sh2-Rc2	11	T2-E3-Sh2-Rc3	21	T3-El3-E3-Sh3-Rc2
2	El2	12	T2-El2	22	T3-El3-E3-Sh3-Rc3
3	El2-Rc2	13	T2-El2-E3-Sh2-Rc2		
4	El2-Sh2-Rc2	14	T2-El2-E3-Sh2-Rc3		
5	El2-Sh2-Rc3	15	T3		
6	F2-D2	16	T3-E3		
7	Sh2-Rc2	17	T3-E3-Sh3-Rc2		
8	T2	18	T3-E3-Sh3-Rc3		
9	T2-E3	19	T3-El2-E3-Sh3-Rc2		
10	T2-E3-Sh2-Rc2	20	T3-El2-E3-Sh3-Rc3		

CODE	LAND USE
2	Non-Irrigated rice
4	Corn
81	Coffee
82	Cacao
112	Sugarcane
116	Coconut
126	Grassland
134	Shrubland, unmanaged

LAND SUITABILITY MAP FOR CACAO

LAND RESOURCES EVALUATION AND SUITABILITY ASSESSMENT OF STRATEGIC PRODUCTION AREAS

QUEZON, REGION IV-A

EXTENT OF SUITABILITY FOR CACAO PRODUCTION BY MUNICIPALITY

MUNICIPALITY	EXISTING CACAO (Ha)			TOTAL EXISTING AREA (Ha)	EXPANSION AREA (Ha)						CONFLICT RESOLUTION (Ha)						TOTAL POTENTIAL EXPANSION AREA (Ha)
					Coconut		Shrubland, unmanaged*		Grassland, unmanaged*		Corn		Rice paddy, non-irrigated		Other crops		
	S1	S2	S3		S1	S2	S1	S2	S1	S2	S1	S2	S1	S2	S1	S2	
AGDANGAN	-	-	-	-	2,922	-	-	-	66	-	66	-	5	-	-	-	3,060
ALABAT	-	-	-	-	2,699	32	250	40	474	-	474	7	44	-	-	-	4,021
ATIMONAN	-	-	-	-	6,911	205	349	262	340	-	340	16	149	-	-	-	8,572
BUENAVISTA	2	-	58	60	6,894	559	31	-	1,337	243	1,590	425	117	10	-	-	11,197
BURDEOS	-	-	-	-	3,384	-	10,404	-	281	-	281	4	372	-	-	-	14,726
CALAUAG	-	-	-	-	18,993	-	2,306	-	1,263	-	1,263	6	101	-	-	-	23,933
CANDELARIA	-	-	-	-	4,294	16	76	81	3,222	32	3,222	85	1,789	-	-	-	12,818
CATANAUAN	-	-	-	-	13,463	-	213	-	3,753	-	3,753	62	276	-	-	-	21,521
CITY OF TAYABAS	25	-	92	117	13,448	505	524	112	1,608	217	1,608	286	876	-	-	-	19,185
DOLORES	-	-	-	-	1,696	-	2,420	212	754	13	754	56	107	-	-	-	6,012
GENERAL LUNA	-	-	-	-	6,174	-	85	-	989	-	989	13	-	-	-	-	8,251
GENERAL NAKAR	-	-	-	-	1,041	10	240	7	81	4	81	6	224	2	-	-	1,696
GUINAYANGAN	-	-	-	-	12,762	-	2,963	12	147	-	147	6	101	-	-	-	16,139
GUMACA	-	-	-	-	11,829	10	-	-	397	-	397	24	-	-	-	-	12,657
INFANTA	-	-	-	-	1,577	34	80	-	1,213	-	1,213	-	204	-	-	-	4,321
JOMALIG	-	-	-	-	21	-	3,384	-	338	-	338	-	-	-	-	-	4,081
LOPEZ	-	-	-	-	22,832	-	1,502	-	432	-	432	75	433	-	-	-	25,707
LUCBAN	-	-	-	-	5,142	702	1,330	158	743	171	743	193	249	-	-	-	9,430
LUCENA CITY	-	-	-	-	2,199	29	-	-	2,543	2	2,545	-	918	2	-	-	8,228
MACALELON	-	-	-	-	5,542	90	772	-	379	-	379	41	-	-	-	-	7,203
MAUBAN	-	-	-	-	6,989	18	3,460	556	448	-	448	36	207	-	-	-	12,160
MULANAY	-	-	-	-	15,099	311	1,398	5	870	-	870	207	294	-	-	-	19,044
PADRE BURGOS	-	-	-	-	4,112	-	80	-	160	-	160	3	14	-	-	-	4,529
PAGBILAO	1	4	36	41	6,734	1	481	214	894	-	894	4	749	-	-	-	9,972
PANUKULAN	-	-	-	-	4,741	-	2,423	-	360	-	360	31	34	-	-	-	7,949
PATNANUNGAN	-	-	-	-	3,140	-	4,395	-	82	-	82	-	68	-	-	-	7,767
PEREZ	28	-	39	67	2,970	-	50	-	91	-	91	4	-	-	-	-	3,205
PITOGO	-	-	-	-	6,125	-	-	-	339	-	339	3	-	-	-	-	6,807
PLARIDEL	-	-	-	-	686	12	-	-	47	-	47	2	6	-	-	-	801
POLILLO	49	5	44	98	10,521	915	6,358	174	298	-	298	1	352	-	-	-	18,917
QUEZON	21	5	93	119	3,511	94	19	-	419	-	419	10	-	-	-	-	4,473
REAL	2	-	46	48	234	-	611	-	27	-	27	-	8	-	-	-	907
SAMPALOC	-	-	-	-	1,108	-	2,909	87	82	-	82	20	13	-	-	-	4,301
SAN ANDRES	-	-	-	-	742	223	304	178	5,646	2,164	7,810	1,914	573	15	-	-	19,569
SAN ANTONIO	-	-	-	-	5,458	30	22	-	-	-	-	-	-	-	-	-	5,510
SAN FRANCISCO	-	-	-	-	9,115	1,250	915	610	4,793	2,621	7,414	816	453	28	-	-	28,016
SAN NARCISO	37	-	18	55	6,166	297	1,942	25	3,941	59	4,000	925	325	11	-	-	17,691
SARIAYA	-	-	-	-	9,644	141	24	43	4,742	411	4,742	566	2,551	-	21	-	22,886
TAGKAWAYAN	-	-	-	-	10,086	19	15,046	249	504	-	504	25	414	-	-	-	26,846
TIAONG	-	-	-	-	4,436	-	1,571	4	1,170	-	1,170	-	967	-	-	-	9,319
UNISAN	-	-	-	-	8,204	-	-	-	598	-	598	2	53	-	-	-	9,455
TOTAL	166	14	426	**606**	263,634	5,501	68,940	3,030	45,873	5,937	50,962	5,876	13,040	68	21	-	**462,883**

† the onset of rainy season.

*establishment of shade trees prior to planting of cacao.

AGRONOMIC REQUIREMENT OF CACAO PRODUCTION

LAND UTILIZATION TYPE	SUITABILITY RATING	SLOPE (%)	SOIL DEPTH (cm)	SOIL TEXTURE	SOIL DRAINAGE	SOIL REACTION (pH)	INHERENT FERTILITY	FLOODING CLASS	EROSION CLASS	ROCK OUTCROPS	ELEVATION (masl)	ANNUAL RAINFALL (mm)	CLIMATIC TYPE
Cacao	S1	<8	>100	CL, SiCL, SCL, SC, SiC, C, HC	WD,MWD	5.6 -7.2	high	none-slight	none-slight	none-few	<1000	2001-4500	I, III, IV
	S2	8 - 30	50 - 100	FSL, L, SIL	SPD,PD	5.1 - 5.5 7.3 - 7.8	medium	moderate	moderate	common	1000-1500	1000-2000	I, II
	S3	>30	<50	S, LS, CSL, SL	VPD,ED	<5.0 - > 7.9	low	severe	severe	many	>1500	<1000 >4500	

SLOPE (%)
- 0 - 3 - level to gently sloping
- 3 - 8 - gently sloping to undulating
- 8 - 18 - undulating to rolling
- 18 - 30 - rolling to moderately steep
- 30 - 50 - steep
- > 50 - very steep

SOIL DEPTH (cm)
- 0 - 30 - very shallow
- 30 - 50 - shallow
- 50 - 100 - moderately deep
- > 100 - deep to very deep

SOIL DRAINAGE
- ED - excessively drained
- WD - well drained
- MWD - moderately well drained
- SPD - somewhat poorly drained
- PD - poorly drained
- VPD - very poorly drained

SURFACE IMPEDIMENT
- ROCK OUTCROPS
- < 10% - none - few
- 10 - 30% - common
- > 30% - many

SOIL REACTION (pH)
- < 4.5 - extremely acid
- 4.5 - 5.0 - very strongly acid
- 5.1 - 5.5 - strongly acid
- 5.6 - 6.0 - medium acid
- 6.1 - 6.5 - slightly acid
- 6.6 - 7.2 - neutral
- 7.3 - 7.8 - mildly alkaline
- 7.9 - 8.4 - moderately alkaline
- > 8.5 - strongly alkaline

SOIL TEXTURE

Coarse
- S - sand
- LS - loamy sand
- CSL - coarse sandy loam
- SL - sandy loam

Medium
- FSL - fine sandy loam
- L - loam
- SiL - silt loam
- CL - clay loam
- SiCL - silty clay loam
- SCL - sandy clay loam

Fine
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- SiC - silty clay
- C - clay
- HC - heavy clay

LAND LIMITATIONS DESCRIPTION AND COMBINATIONS

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- El3 - > 1500m

SLOPE/TOPOGRAPHY
- T2 - Undulating to moderately steep
- T3 - Steep to very steep

SOIL DRAINAGE
- D2 - Somewhat poorly drained to poorly drained
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SOIL TEXTURE
- Tc - Coarse texture

SOIL DEPTH
- Sh2 - Moderately deep (50 - 100cm)
- Sh3 - Very shallow to shallow (< 50cm)

ROCK OUTCROPS
- Rc2 - Common
- Rc3 - Many

SOIL EROSION
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- E3 - Severe erosion

FLOODING
- F2 - Moderate seasonal flooding
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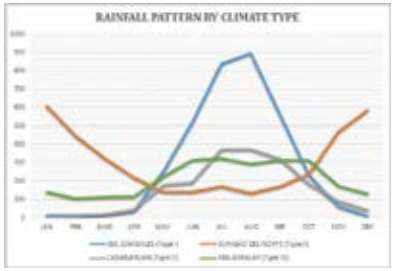
TYPE IV : Rainfall is more or less evenly distributed throughout the year. This type resembles Type II since it has no dry season.

Western part of Quezon Province is classified as climatic Type II.



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1	E2-Sh2-Rc2	11	T2	21	T2-F2-D2	31	T3-El2-E3-Sh3-Rc3
2	El2	12	T2-E3	22	T2-F3-D2	32	T3-El2-E3-Sh3-Rc2
3	El2-Rc2	13	T2-E3-Rc2	23	T3	33	T3-El2-E3-Sh3-Rc3
4	El2-Sh2-Rc2	14	T2-E3-Rc3	24	T3-E3	34	T3-El3-E3-Sh3-Rc2
5	El2-Sh2-Rc3	15	T2-E3-Sh2-Rc2	25	T3-E3-Rc2	35	T3-El3-E3-Sh3-Rc3
6	El3-Sh2-Rc2	16	T2-E3-Sh2-Rc3	26	T3-E3-Rc3	36	T3-F2-D2
7	F2-D2	17	T2-El2	27	T3-El3-Sh2-Rc3	37	T3-F3-D2
8	F3-D2	18	T2-El2-E3-Sh2-Rc2	28	T3-El3-Sh3-Rc2	38	Tc
9	Sh2	19	T2-El2-E3-Sh2-Rc3	29	T3-E3-Sh3-Rc3		
10	Sh2-Rc2	20	T2-El3-E3-Sh2-Rc2	30	T3-El2		

CODE	LAND USE
2	Rice paddy, non-irrigated
4	Corn
34	Coffee
81	Cacao
82	Coconut
112	Grassland
116	Coconut
126	Grassland
134	Shrubland, unmanaged

LAND SUITABILITY MAP FOR CACAO

LAND RESOURCES EVALUATION AND SUITABILITY ASSESSMENT OF STRATEGIC PRODUCTION AREAS

ILOILO, REGION VI

EXTENT OF SUITABILITY FOR CACAO PRODUCTION BY MUNICIPALITY

MUNICIPALITY	EXISTING CACAO (Ha)			TOTAL EXISTING AREA (Ha)	EXPANSION AREA (Ha)						CONFLICT RESOLUTION (Ha)								TOTAL POTENTIAL EXPANSION AREA (Ha)
					Coconut		Shrubland, unmanaged*		Grassland, unmanaged*		Rice paddy, non-irrigated		Corn		Sugarcane		Other crops		
	S1	S2	S3		S1	S2	S1	S2	S1	S2	S1	S2	S1	S2	S1	S2	S1	S2	
AJUY	-	-	-	-	3,096	1	1,065	49	1,271	13	1,071	-	589	7	49	-	69	-	7,280
ALIMODIAN	-	-	-	-	37	-	2,651	3	-	-	420	-	708	-	-	-	-	-	3,818
ANILAO	-	-	3	3	89	-	482	401	232	352	2,590	153	1,186	322	-	-	-	-	5,806
BADIANGAN	-	-	-	-	2	58	496	1,574	-	-	543	325	1,199	1,232	-	-	-	-	5,429
BALASAN	-	-	-	-	360	-	3	-	-	-	1,312	-	487	-	27	-	55	-	2,244
BANATE	-	-	-	-	245	26	14	-	82	320	1,514	90	714	61	-	-	-	-	3,070
BAROTAC NUEVO	-	-	5	5	-	-	200	-	-	-	1,839	-	1,491	-	-	-	-	-	3,531
BAROTAC VIEJO	-	-	-	-	638	974	70	2	1,366	1,104	2,608	287	929	205	-	-	-	-	8,183
BATAD	-	-	3	3	181	-	45	-	36	-	812	-	1,084	5	-	-	-	-	2,164
BINGAWAN	-	-	-	-	-	-	1,646	-	21	-	350	-	2,988	-	-	-	-	-	5,006
CABATUAN	-	-	-	-	721	-	1,753	-	62	-	4,795	-	640	-	-	-	-	-	7,972
CALINOG	-	-	10	10	-	-	1,062	-	533	-	1,229	-	6,257	-	-	-	-	-	9,081
CARLES	-	-	-	-	1,422	-	221	-	209	-	1,045	-	933	-	405	-	69	-	4,304
CITY OF PASSI	-	-	1	1	-	-	1,116	479	3,771	720	3,715	72	8,548	616	12	-	-	-	19,048
CONCEPCION	-	-	17	17	1,738	-	856	23	524	19	454	-	248	-	1	-	-	-	3,862
DINGLE	-	-	2	2	-	-	501	702	-	-	1,215	81	2,820	960	-	-	-	-	6,277
DUEÑAS	-	-	-	-	-	-	112	409	-	-	1,817	440	2,835	2,400	-	-	-	-	8,013
DUMANGAS	-	-	-	-	-	-	-	-	-	-	1,494	-	1,367	-	-	-	-	-	2,862
ESTANCIA	-	-	-	-	299	-	80	-	81	-	848	-	577	-	-	-	-	-	1,886
GUIMBAL	-	-	-	-	29	-	1,716	-	10	-	577	-	1,072	-	-	-	-	-	3,403
IGBARAS	-	-	1	1	-	-	2,975	-	-	-	288	-	752	-	-	-	-	-	4,015
ILOILO CITY	-	-	-	-	66	-	11	-	2	-	665	-	263	-	-	-	-	-	1,007
JANIUAY	-	-	-	-	783	48	187	280	56	-	1,753	222	3,745	719	-	-	-	-	7,794
LAMBUNAO	-	-	1	1	-	-	1,872	607	723	241	1,304	292	6,355	2,256	-	-	-	-	13,649
LEGANES	-	-	-	-	30	-	-	-	-	-	466	-	300	-	-	-	-	-	795
LEMERY	-	-	-	-	2,144	-	866	-	1,735	-	2,579	-	109	-	550	-	158	-	8,141
LEON	21	-	8	29	106	-	4,197	8	6	-	313	-		-	-	-	-	-	4,629
MAASIN	-	-	1	1	1,026	-	1,077	-	226	-	1,548	-	520	-	-	-	-	-	4,398
MIAGAO	-	-	-	-	15	-	2,025	-	2,092	8	979	1	637	-	-	-	-	-	5,756
MINA	-	-	-	-	-	-	91	118	-	-	834	17	1,072	9	-	-	-	-	2,141
NEW LUCENA	-	-	-	-	262	-	-	-	-	-	2,253	-	348	-	-	-	-	-	2,863
OTON	-	-	-	-	108	-	44	-	-	-	2,161	-	978	-	-	-	-	-	3,291
PAVIA	-	-	-	-	72	-	-	-	-	-	431	-	316	-	-	-	-	-	819
POTOTAN	-	-	-	-	-	-	43	-	-	-	2,018	6	2,518	92	-	-	-	-	4,676
SAN DIONISIO	-	-	-	-	707	-	622	-	1,313	-	2,060	-	306	-	91	-	250	-	5,349
SAN ENRIQUE	-	-	3	3	108	-	98	127	2,700	64	1,755	33	1,783	194	25	-	25	-	6,911
SAN JOAQUIN	-	-	7	7	12	-	1,282	1	2,957	6	1,431	-	233	-	-	-	-	-	5,921
SAN MIGUEL	-	-	-	-	18	-	308	-	-	-	674	-	694	-	-	-	-	-	1,694
SAN RAFAEL	-	-	-	-	137	3	258	-	262	-	1,280	-	271	-	777	-	403	-	3,392
SANTA BARBARA	-	-	-	-	254	-	-	-	-	-	3,167	-	1,606	-	-	-	-	-	5,027
SARA	-	-	-	-	823	6	504	4	3,144	22	2,488	-	224	-	141	-	832	-	8,188
TIGBAUAN	-	-	-	-	161	-	3,827	-	14	-	1,527	-	861	-	-	-	-	-	6,390
TUBUNGAN	-	-	-	-	-	-	1,724	16	-	-	46	-	241	-	-	-	-	-	2,027
ZARRAGA	-	-	-	-	69	-	-	-	-	-	694	-	878	-	-	-	-	-	1,641
TOTAL	21	-	62	83	15,757	1,116	36,100	4,803	23,427	2,869	62,961	2,019	61,685	9,079	2,078	-	1,861	-	223,754

Note: Delivery of cacao planting materials must be started on the onset of rainy season.
**establishment of shade trees prior to planting of cacao.*

AGRONOMIC REQUIREMENT OF CACAO PRODUCTION

LAND UTILIZATION TYPE	SUITABILITY RATING	SLOPE (%)	SOIL DEPTH (cm)	SOIL TEXTURE	SOIL DRAINAGE	SOIL REACTION (pH)	INHERENT FERTILITY	FLOODING CLASS	EROSION CLASS	ROCK OUTCROPS	ELEVATION (masl)	ANNUAL RAINFALL (mm)	CLIMATIC TYPE
Cacao	S1	<8	>100	CL, SiCL, SCL, SC, SiC, C, HC	WD,MWD	5,6 - 7,2	high	none-slight	none-slight	none-few	<1000	2001-4500	I, III, IV
	S2	8 - 30	50 - 100	FSL, L, SiL	SPD,PD	5,1 - 5,5 7,3 - 7,8	medium	moderate	moderate	common	1000-1500	1000-2000	I, II
	S3	>30	<50	S, LS, CSL, SL	VPD,ED	<5,0 - > 7,9	low	severe	severe	many	>1500	<1000 >4500	

SLOPE (%)
0 - 3 - level to gently sloping
3 - 8 - gently sloping to undulating
8 - 18 - undulating to rolling
18 - 30 - rolling to moderately steep
30 - 50 - steep
> 50 - very steep

SOIL DEPTH (cm)
0 - 30 - very shallow
30 - 50 - shallow
50 - 100 - moderately deep
> 100 - deep to very deep

SOIL DRAINAGE
ED - excessively drained
WD - well drained
MWD - moderately well drained
SPD - somewhat poorly drained
PD - poorly drained
VPD - very poorly drained

SURFACE IMPEDIMENT
ROCK OUTCROPS
< 10% - none - few
10 - 30% - common
> 30% - many

SOIL REACTION (pH)
< 4,5 - extremely acid
4,5 - 5,0 - very strongly acid
5,1 - 5,5 - strongly acid
5,6 - 6,0 - medium acid
6,1 - 6,5 - slightly acid
6,6 - 7,2 - neutral
7,3 - 7,8 - mildly alkaline
7,9 - 8,4 - moderately alkaline
> 8,5 - strongly alkaline

SOIL TEXTURE
Coarse
S - sand
LS - loamy sand
CSL - coarse sandy loam
SL - sandy loam
Medium
FSL - fine sandy loam
L - loam
SiL - silt loam
CL - clay loam
SiCL - silty clay loam
SCL - sandy clay loam
Fine
SC - sandy clay
SiC - silty clay
C - clay
HC - heavy clay

LAND LIMITATIONS DESCRIPTION AND COMBINATIONS

ELEVATION
El2 - 1000m - 1500m
El3 - > 1500m

SLOPE/TOPOGRAPHY
T2 - Undulating to moderately steep
T3 - Steep to very steep

SOIL DRAINAGE
D2 - Somewhat poorly drained to poorly drained
D3 - Very poorly drained or excessively drained

SOIL TEXTURE
Tc - Coarse texture

SOIL DEPTH
Sh2 - Moderately deep (50 - 100cm)
Sh3 - Very shallow to shallow (< 50cm)

ROCK OUTCROPS
Rc2 - Common
Rc3 - Many

SOIL EROSION
E2 - Moderate erosion
E3 - Severe erosion

FLOODING
F2 - Moderate seasonal flooding
F3 - Severe seasonal flooding

SUITABILITY CLASSES:

Highly Suitable (S1)
Land having no significant limitation to sustained application of a given use, or only minor limitations that will not significantly reduce productivity or benefits and will not raise inputs above an acceptable level.

Moderately Suitable (S2)
Land having limitation which in aggregate are moderately severe for sustained application of a given use; the limitation will reduce productivity or benefits and increase required inputs to the extent that the overall advantage to be gained from the use, although still attractive, will be appreciably inferior to that expected on class S1 land.

Marginally Suitable (S3)
Land having limitations which in aggregate are severe for sustained application of a given use and will so reduce productivity or benefits, or increase required inputs, that this expenditure will be only marginally justified.

Not Suitable / Not Relevant
Land having limitations which may be surmountable in time but which cannot be corrected with existing knowledge at currently acceptable cost; the limitations are so severe as to preclude successful sustained use of the land in the given manner. Existing forest, shrubland greater than 18% slope, irrigated paddy rice and miscellaneous land types such as built up areas, roads, etc are considered as not relevant.

CLIMATE TYPE

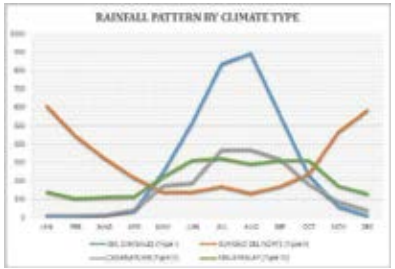
TYPE I : Two pronouced season, dry from November to April and wet during the rest of the year. Maximum rain period is from June to September

TYPE II : No dry season with a very pronounced maximum rain period from December to February. There is not a single dry month. Maximum monthly rainfall occurs during the period from March to May.

TYPE III : No very pronounced maximum rain period, with a dry season lasting only from one to three months, either during the period from December to February or from March to May. This type resembles Type I since it has a short dry season.

TYPE IV : Rainfall is more or less evenly distributed throughout the year. This type resembles Type II since it has no dry season.

Southern part of Iloilo is classified as climatic Type I and Northern part belongs to Type III.



Source: PAGASA 2018, *Climatalogical Normals (Rainfall)*, Philippine Atmospheric, Geophysical and Astronomical Services Administration (PAGASA), accessed 27 July 2018, <https://www1.pagasa.dost.gov.ph/index.php/climate/climatological-normals>.

CODE	LAND LIMITATION	CODE	LAND LIMITATION	CODE	LAND LIMITATION	CODE	LAND LIMITATION
1	E2-Sh2-Rc2	11	T2-E3	21	T2-F2-D2	31	T3-El2-E3-Rc2
2	El2	12	T2-E3-Rc2	22	T2-F3-D2	32	T3-El2-E3-Rc3
3	El2-E2-Rc3	13	T2-E3-Rc3	23	T3	33	T3-El2-E3-Sh2-Rc3
4	El2-E3-Rc3	14	T2-E3-Sh2-Rc2	24	T3-E3	34	T3-El2-E3-Sh3-Rc2
5	El2-Rc2	15	T2-E3-Sh2-Rc3	25	T3-E3-Rc2	35	T3-El2-E3-Sh3-Rc3
6	El2-Sh2-Rc3	16	T2-El2	26	T3-E3-Rc3	36	T3-El3-E3-Sh3-Rc3
7	F2-D2	17	T2-El2-E3-Rc2	27	T3-E3-Sh2-Rc3	37	T3-F3-D2
8	F3-D2	18	T2-El2-E3-Rc3	28	T3-E3-Sh3-Rc2		
9	Sh2-Rc2	19	T2-El2-E3-Sh2-Rc2	29	T3-E3-Sh3-Rc3		
10	T2	20	T2-El2-E3-Sh2-Rc3	30	T3-El2		

CODE	LAND USE
2	Non-irrigated rice
4	Corn
34	Diversified crops
81	Coffee
82	Cacao
112	Sugarcane
116	Coconut
126	Grassland
134	Shrubland, unmanaged

LAND SUITABILITY MAP FOR CACAO

LAND RESOURCES EVALUATION AND SUITABILITY ASSESSMENT OF STRATEGIC PRODUCTION AREAS

PALAWAN, REGION IV-B

EXTENT OF SUITABILITY FOR CACAO PRODUCTION BY MUNICIPALITY

MUNICIPALITY	EXISTING CACAO (Ha)			TOTAL EXISTING AREA (Ha)	EXPANSION AREA (Ha)						CONFLICT RESOLUTION (Ha)						TOTAL POTENTIAL EXPANSION AREA (Ha)
					Coconut		Shrubland, unmanaged*		Grassland, unmanaged*		Rice paddy, non-irrigated		Corn		Other crops		
	S1	S2	S3		S1	S2	S1	S2	S1	S2	S1	S2	S1	S2	S1	S2	
ABORLAN	-	-	-	-	14,186	1,202	2,897	2,444	338	46	4,372	283	2	-	-	-	25,772
AGUTAYA	-	-	-	-	96	74	-	-	1,656	99	-	-	-	-	-	-	1,924
ARACELI	-	-	-	-	4	159	300	3,399	66	584	721	1,154	-	14	-	-	6,402
BALABAC	-	-	-	-	16,565	-	1,877	43	765	7	26	-	-	-	-	-	19,283
BATARAZA	46	6	64	116	20,127	666	8,454	481	1,652	16	5,487	16	-	-	-	-	36,900
BROOKE'S POINT	22	10	29	61	19,256	835	2,051	474	-	-	8,041	27	-	-	-	-	30,684
BUSUANGA	-	-	-	-	14	25	2,353	2,604	3,808	2,999	729	514	4	2	-	-	13,054
CORON	-	-	-	-	37	95	1,793	3,693	5,501	4,962	494	294	-	-	-	-	16,869
CULION	-	-	-	-	5	9	517	2,373	2,090	5,448	1,538	775	41	21	-	-	12,818
CUYO	-	-	-	-	3,014	195	368	-	56	34	38	-	6	-	-	-	3,711
DUMARAN	-	-	-	-	87	99	556	2,905	1,715	4,637	3,079	1,710	-	1	-	-	14,789
EL NIDO	-	-	-	-	1,085	189	2,425	2,853	1,866	1,770	3,455	991	34	4	-	-	14,672
LINAPACAN	-	-	-	-	-	129	18	570	72	765	7	301	2	37	-	-	1,902
MAGSAYSAY	-	-	-	-	3,302	155	3	-	231	132	44	17	5	8	-	-	3,898
NARRA	-	-	-	-	6,317	501	6,286	3,045	1,404	102	16,330	195	8	-	-	-	34,267
PUERTO PRINCESA CITY	-	-	-	-	8,142	4,574	8,780	5,587	1,836	955	9,190	1,332	70	3	-	-	40,469
QUEZON	4	8	13	25	12,133	4,584	9,262	8,094	842	11	3,823	202	11	-	-	-	38,962
RIZAL	29	5	15	48	11,208	1,166	24,961	3,055	11	2	5,154	129	-	-	-	3	45,689
ROXAS	-	-	-	-	1,365	1,122	1,049	2,878	6,180	11,622	2,208	1,344	-	-	-	-	27,767
SAN VICENTE	-	-	-	-	130	418	87	741	1,600	3,604	2,063	1,135	75	31	-	-	9,884
SOFRONIO ESPAÑOLA	12	17	21	51	7,023	6,151	2,899	8,158	7	15	1,799	365	-	-	-	-	26,416
TAYTAY	-	-	-	-	680	226	3,247	4,381	5,136	5,649	9,097	1,424	66	33	-	-	29,939
TOTAL	113	46	142	**301**	124,777	22,574	80,184	57,779	36,913	43,460	77,695	12,206	325	154	-	3	**456,069**

Note: Delivery of cacao planting materials must be started on the onset of rainy season.
**establishment of shade trees prior to planting of cacao.*

SUITABILITY CLASSES:

Highly Suitable (S1)
Land having no significant limitation to sustained application of a given use, or only minor limitations that will not significantly reduce productivity or benefits and will not raise inputs above an acceptable level.

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Land having limitation which in aggregate are moderately severe for sustained application of a given use; the limitation will reduce productivity or benefits and increase required inputs to the extent that the overall advantage to be gained from the use, although still attractive, will be appreciably inferior to that expected on class S1 land.

Marginally Suitable (S3)
Land having limitations which in aggregate are severe for sustained application of a given use and will so reduce productivity or benefits, or increase required inputs, that this expenditure will be only marginally justified.

Not Suitable / Not Relevant
Land having limitations which may be surmountable in time but which cannot be corrected with existing knowledge at currently acceptable cost; the limitations are so severe as to preclude successful sustained use of the land in the given manner, Existing forest, shrubland greater than 18% slope, irrigated paddy rice and miscellaneous land types such as built up areas, roads, etc are considered as not relevant.

AGRONOMIC REQUIREMENT OF CACAO PRODUCTION

LAND UTILIZATION TYPE	SUITABILITY RATING	SLOPE (%)	SOIL DEPTH (cm)	SOIL TEXTURE	SOIL DRAINAGE	SOIL REACTION (pH)	INHERENT FERTILITY	FLOODING CLASS	EROSION CLASS	ROCK OUTCROPS	ELEVATION (masl)	ANNUAL RAINFALL (mm)	CLIMATIC TYPE
Cacao	S1	<8	>100	CL, SiCL, SCL, SC, SiC, C, HC	WD,MWD	5.6 -7.2	high	none-slight	none-slight	none-few	<1000	2001-4500	I, III, IV
	S2	8 - 30	50 - 100	FSL, L, SiL	SPD,PD	5.1 - 5.5 7.3 - 7.8	medium	moderate	moderate	common	1000-1500	1000-2000	I, II
	S3	>30	<50	S, LS, CSL, SL	VPD,ED	<5.0 - > 7.9	low	severe	severe	many	>1500	<1000 >4500	

SLOPE (%)
0 - 3 - level to gently sloping
3 - 8 - gently sloping to undulating
8 - 18 - undulating to rolling
18 - 30 - rolling to moderately steep
30 - 50 - steep
> 50 - very steep

SOIL DRAINAGE
ED - excessively drained
WD - well drained
MWD - moderately well drained
SPD - somewhat poorly drained
PD - poorly drained
VPD - very poorly drained

SOIL REACTION (pH)
< 4.5 - extremely acid
4.5 - 5.0 - very strongly acid
5.1 - 5.5 - strongly acid
5.6 - 6.0 - medium acid
6.1 - 6.5 - slightly acid
6.6 - 7.2 - neutral
7.3 - 7.8 - mildly alkaline
7.9 - 8.4 - moderately alkaline
> 8.5 - strongly alkaline

SOIL TEXTURE
Coarse
S - sand
LS - loamy sand
CSL - coarse sandy loam
SL - sandy loam
Medium
FSL - fine sandy loam
L - loam
SiL - silt loam
CL - clay loam
SiCL - silty clay loam
SCL - sandy clay loam
Fine
SC - sandy clay
SiC - silty clay
C - clay
HC - heavy clay

SOIL DEPTH (cm)
0 - 30 - very shallow
30 - 50 - shallow
50 - 100 - moderately deep
> 100 - deep to very deep

SURFACE IMPEDIMENT
ROCK OUTCROPS
< 10% - none - few
10 - 30% - common
> 30% - many

LAND LIMITATIONS DESCRIPTION AND COMBINATIONS

ELEVATION
EI2 - 1000m - 1500m
EI3 - > 1500m

SOIL DRAINAGE
D2 - Somewhat poorly drained to poorly drained
D3 - Very poorly drained or excessively drained

SOIL DEPTH
Sh2 - Moderately deep (50 - 100cm)
Sh3 - Very shallow to shallow (< 50cm)

SOIL EROSION
E2 - Moderate erosion
E3 - Severe erosion

SLOPE/TOPOGRAPHY
T2 - Undulating to moderately steep
T3 - Steep to very steep

SOIL TEXTURE
Tc - Coarse texture

ROCK OUTCROPS
Rc2 - Common
Rc3 - Many

FLOODING
F2 - Moderate seasonal flooding
F3 - Severe seasonal flooding

CODE	LAND LIMITATION	CODE	LAND LIMITATION	CODE	LAND LIMITATION	CODE	LAND LIMITATION
1	E2	13	T2	25	T2-EI3-E3-Rc3	37	T3-EI2-E3-Rc2
2	E2-Sh2-Rc2	14	T2-E3	26	T2-F2-D2	38	T3-EI2-E3-Rc3
3	EI2	15	T2-E3-Rc2	27	T2-F3-D2	39	T3-EI2-E3-Sh2-Rc3
4	EI2-E3-Rc3	16	T2-E3-Rc3	28	T3	40	T3-EI2-E3-Sh3-Rc3
5	EI2-Rc2	17	T2-E3-Sh2-Rc2	29	T3-E3	41	T3-EI3
6	EI2-Sh2-Rc2	18	T2-E3-Sh2-Rc3	30	T3-E3-Rc2	42	T3-EI3-E3
7	EI3	19	T2-EI2	31	T3-E3-Rc3	43	T3-EI3-E3-Sh2-Rc3
8	EI3-E3-Rc3	20	T2-EI2-E3	32	T3-E3-Sh2-Rc3	44	T3-EI3-E3-Sh3-Rc3
9	F2-D1	21	T2-EI2-E3-Rc2	33	T3-E3-Sh3-Rc2	45	T3-F3-D2
10	F3-D1	22	T2-EI2-E3-Rc3	34	T3-E3-Sh3-Rc3	46	Tc
11	Sh2	23	T2-EI2-E3-Sh2-Rc3	35	T3-EI2		
12	Sh2-Rc2	24	T2-EI3-E3	36	T3-EI2-E3		

CODE	LAND USE
2	Rice paddy, non-irrigated
4	Corn
81	Coffee
82	Cacao
116	Coconut
126	Grassland
134	Shrubland, unmanaged
137	Rubber

CLIMATE TYPE

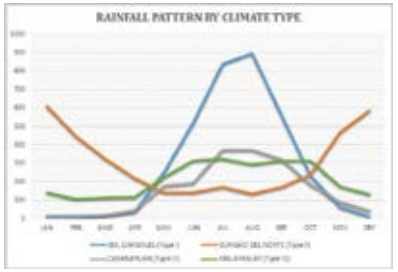
TYPE I : Two pronounced season, dry from November to April and wet during the rest of the year, Maximum rain period is from June to September

TYPE II : No dry season with a very pronounced maximum rain period from December to February, There is not a single dry month, Maximum monthly rainfall occurs during the period from March to May,

TYPE III : No very pronounced maximum rain period, with a dry season lasting only from one to three months, either during the period from December to February or from March to May, This type resembles Type I since it has a short dry season,

TYPE IV : Rainfall is more or less evenly distributed throughout the year, This type resembles Type II since it has no dry season,

Northwestern part of Palawan belongs to climatic Type I and southeast part of the island is Type III.



Source: PAGASA 2018, *Climatological Normals (Rainfall)*, Philippine Atmospheric, Geophysical and Astronomical Services Administration (PAGASA), accessed 27 July 2018, <https://www1.pagasa.dost.gov.ph/index.php/climate/climatological-normals>.

LAND SUITABILITY MAP FOR CACAO

LAND RESOURCES EVALUATION AND SUITABILITY ASSESSMENT OF STRATEGIC PRODUCTION AREAS

BOHOL, REGION VII

EXTENT OF SUITABILITY FOR CACAO PRODUCTION BY MUNICIPALITY

MUNICIPALITY	EXISTING CACAO (Ha)			TOTAL EXISTING AREA (Ha)	EXPANSION AREA (Ha)						CONFLICT RESOLUTION (Ha)						TOTAL POTENTIAL EXPANSION AREA (Ha)
					Coconut		Shrubland, unmanaged*		Grassland, unmanaged*		Corn		Rice paddy, non-irrigated		Other crops		
	S1	S2	S3		S1	S2	S1	S2	S1	S2	S1	S2	S1	S2	S1	S2	
ALBUQUERQUE	-	-	-	-	1,906	40	18	40	106	-	245	-	-	-	-	-	2,355
ALICIA	-	-	-	-	2,368	365	119	93	1,380	45	568	-	722	-	-	-	5,660
ANDA	-	-	-	-	726	1,200	200	875	-	-	32	2	48	1	-	-	3,084
ANTEQUERA	-	-	-	-	2,725	32	2,011	61	1	-	69	-	18	-	-	-	4,917
BACLAYON	-	-	-	-	1,013	-	-	-	1,334	-	317	-	35	-	-	-	2,700
BALILIHAN	-	-	-	-	828	-	1,550	267	4,814	13	-	-	30	1	-	-	7,504
BATUAN	10	-	1	11	963	-	2,314	49	-	-	851	-	245	-	-	-	4,422
BIEN UNIDO	-	-	-	-	189	-	-	-	-	-	456	-	493	-	-	-	1,137
BILAR	-	-	5	5	1,512	96	1,180	227	9	205	741	44	311	16	-	-	4,341
BUENAVISTA	19	-	7	26	6,016	-	160	-	3,496	-	80	-	388	-	-	-	8,138
CALAPE	-	-	-	-	2,927	-	-	-	-	-	174	-	279	-	-	-	3,381
CANDIJAY	-	-	-	-	2,462	884	198	173	15	8	168	-	325	50	-	-	4,283
CARMEN	-	-	-	-	9,505	1,414	174	25	718	256	2,196	87	2,259	309	-	-	16,943
CATIGBIAN	4	-	2	6	3,182	2,172	1,694	206	-	-	145	686	203	236	-	-	8,524
CLARIN	-	-	-	-	2,849	288	-	-	-	-	150	536	112	65	-	-	3,180
CORELLA	-	-	-	-	563	4	130	37	2,242	-	-	-	4	-	-	-	2,980
CORTES	-	-	-	-	754	-	26	-	1,994	-	-	-	5	-	-	-	2,778
DAGOHOY	2	13	-	15	829	181	514	276	7	-	1,898	33	2,242	7	-	-	5,987
DANAO	11	-	1	12	3,628	794	36	151	928	88	902	71	381	66	-	-	7,043
DAUIS	-	-	-	-	200	-	2,376	-	537	-	26	-	92	-	-	-	3,309
DIMIAO	-	-	-	-	895	489	90	45	173	212	926	259	78	45	-	-	3,212
DUERO	-	-	2	2	541	461	-	1	-	-	125	17	34	6	-	-	1,185
GARCIA HERNANDEZ	-	-	-	-	674	930	30	464	175	200	220	109	90	14	-	-	2,906
GETAFE	-	-	-	-	3,269	-	-	-	1,532	-	9	-	753	-	-	-	5,564
GUINDULMAN	-	-	-	-	1,989	1,603	107	65	5	10	46	23	164	33	-	-	4,044
INABANGA	-	-	-	-	5,878	605	27	-	432	-	69	124	260	36	-	-	7,430
JAGNA	-	-	1	1	853	1,393	-	12	-	170	147	65	45	23	-	-	2,707
LILA	-	-	-	-	900	5	-	-	19	40	-	-	36	-	-	-	1,001
LOAY	-	-	-	-	1,684	5	2	-	32	2	31	-	22	-	-	-	1,779
LOBOC	-	-	-	-	1,464	126	88	52	50	258	456	81	47	4	-	-	2,625
LOON	-	-	-	-	3,980	431	657	203	-	-	791	27	357	-	-	-	6,446
MARIBINI	-	-	-	-	1,326	29	30	29	1,862	43	878	-	1,063	-	-	-	5,260
MARIBOJOC	-	-	-	-	2,601	16	482	62	-	-	11	-	16	-	-	-	3,187
PANGLAO	-	-	-	-	630	-	2,280	-	202	-	-	-	450	-	-	-	3,562
PILAR	-	-	5	5	1,226	280	8	43	56	-	3,061	68	2,155	30	-	-	6,926
PRES. CARLOS P. GARCIA	-	-	-	-	2,103	-	-	-	160	-	127	-	474	-	-	-	2,865
SAGBAYAN	3	10	-	13	572	3,843	337	68	-	-	129	1,160	81	613	-	-	6,803
SAN ISIDRO	-	-	-	-	2,348	146	619	21	-	-	83	-	14	1	-	-	3,232
SAN MIGUEL	5	-	3	8	2,815	32	94	10	662	22	3,543	7	2,334	48	-	-	9,567
SEVILLA	-	-	-	-	1,200	20	170	35	185	-	1,981	10	14	-	-	-	3,614
SIERRA BULLONES	-	-	-	-	2,495	762	171	132	-	-	555	285	749	19	-	-	5,168
SIKATUNA	-	3	5	8	1,806	17	244	56	140	11	4	-	3	-	-	-	2,282
TAGBILARAN CITY	-	-	-	-	325	-	-	-	1,355	-	-	-	3	-	-	-	1,683
TALIBON	1	-	-	1	4,802	-	246	-	2,092	-	860	-	2,296	-	-	-	10,295
TRINIDAD	4	-	-	4	1,590	-	21	-	1,646	-	4,975	9	3,447	-	-	-	11,687
TUBIGON	-	-	-	-	2,706	331	-	-	-	-	274	248	295	30	-	-	3,884
UBAY	5	-	5	10	2,479	-	-	-	1,957	-	5,263	-	6,791	-	-	-	16,490
VALENCIA	-	-	-	-	1,131	854	294	209	57	100	778	502	176	35	-	-	4,136
TOTAL	64	26	36	**126**	96,709	19,828	18,698	3,986	30,369	1,685	34,357	4,451	30,438	1,688	-	-	**242,206**

Note: Delivery of cacao planting materials must be started on the onset of rainy season.
**establishment of shade trees prior to planting of cacao.*

AGRONOMIC REQUIREMENT OF CACAO PRODUCTION

LAND UTILIZATION TYPE	SUITABILITY RATING	SLOPE (%)	SOIL DEPTH (cm)	SOIL TEXTURE	SOIL DRAINAGE	SOIL REACTION (pH)	INHERENT FERTILITY	FLOODING CLASS	EROSION CLASS	ROCK OUTCROPS	ELEVATION (masl)	ANNUAL RAINFALL (mm)	CLIMATIC TYPE
Cacao	S1	<8	>100	Cl, SiCl, SCl, SC, SiC, C, HC	WD,MWD	5.6 -7.2	high	none-slight	none-slight	none-few	<1000	2001-4500	I, III, IV
	S2	8 - 30	50 - 100	FSL, L, SiL	SPD,PD	5.1 - 5.5 7.3 - 7.8	medium	moderate	moderate	common	1000-1500	1000-2000	I, II
	S3	>30	<50	S, LS, CSL, SL	VPD,ED	<5,0 - > 7,9	low	severe	severe	many	>1500	<1000 >4500	

SLOPE (%)
0 - 3 - level to gently sloping
3 - 8 - gently sloping to undulating
8 - 18 - undulating to rolling
18 - 30 - rolling to moderately steep
30 - 50 - steep
> 50 - very steep

SOIL DEPTH (cm)
0 - 30 - very shallow
30 - 50 - shallow
50 - 100 - moderately deep
> 100 - deep to very deep

SOIL DRAINAGE
ED - excessively drained
WD - well drained
MWD - moderately well drained
SPD - somewhat poorly drained
PD - poorly drained
VPD - very poorly drained

SURFACE IMPEDIMENT
ROCK OUTCROPS
< 10% - none - few
10 - 30% - common
> 30% - many

SOIL REACTION (pH)
< 4,5 - extremely acid
4,5 - 5,0 - very strongly acid
5,1 - 5,5 - strongly acid
5,6 - 6,0 - medium acid
6,1 - 6,5 - slightly acid
6,6 - 7,2 - neutral
7,3 - 7,8 - mildly alkaline
7,9 - 8,4 - moderately alkaline
> 8,5 - strongly alkaline

SOIL TEXTURE
Coarse
S - sand
LS - loamy sand
CSL - coarse sandy loam
SL - sandy loam
Medium
FSL - fine sandy loam
L - loam
SiL - silt loam
CL - clay loam
SiCL - silty clay loam
SCL - sandy clay loam
Fine
SC - sandy clay
SiC - silty clay
C - clay
HC - heavy clay

LAND LIMITATIONS DESCRIPTION AND COMBINATIONS

ELEVATION
El2 - 1000m - 1500m
El3 - > 1500m

SLOPE/TOPOGRAPHY
T2 - Undulating to moderately steep
T3 - Steep to very steep

SOIL DRAINAGE
D2 - Somewhat poorly drained to poorly drained
D3 - Very poorly drained or excessively drained

SOIL TEXTURE
Tc - Coarse texture

SOIL DEPTH
Sh2 - Moderately deep (50 - 100cm)
Sh3 - Very shallow to shallow (< 50cm)

ROCK OUTCROPS
Rc2 - Common
Rc3 - Many

SOIL EROSION
E2 - Moderate erosion
E3 - Severe erosion

FLOODING
F2 - Moderate seasonal flooding
F3 - Severe seasonal flooding

SUITABILITY CLASSES:

Highly Suitable (S1)
Land having no significant limitation to sustained application of a given use, or only minor limitations that will not significantly reduce productivity or benefits and will not raise inputs above an acceptable level.

Moderately Suitable (S2)
Land having limitation which in aggregate are moderately severe for sustained application of a given use; the limitation will reduce productivity or benefits and increase required inputs to the extent that the overall advantage to be gained from the use, although still attractive, will be appreciably inferior to that expected on class S1 land.

Marginally Suitable (S3)
Land having limitations which in aggregate are severe for sustained application of a given use and will so reduce productivity or benefits, or increase required inputs, that this expenditure will be only marginally justified.

Not Suitable / Not Relevant
Land having limitations which may be surmountable in time but which cannot be corrected with existing knowledge at currently acceptable cost; the limitations are so severe as to preclude successful sustained use of the land in the given manner. Existing forest, shrubland greater than 18% slope, irrigated paddy rice and miscellaneous land types such as built up areas, roads, etc are considered as not relevant.

CLIMATE TYPE

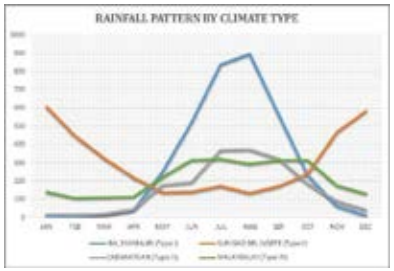
TYPE I : Two pronouced season, dry from November to April and wet during the rest of the yean Maximum rain period is from June to September

TYPE II : No dry season with a very pronounced maximum rain period from December to February. There is not a single dry month. Maximum monthly rainfall occurs during the period from March to May.

TYPE III : No very pronounced maximum rain period, with a dry season lasting only from one to three months, either during the period from December to February or from March to May. This type resembles Type I since it has a short dry season.

TYPE IV : Rainfall is more or less evenly distributed throughout the year, This type resembles Type II since it has no dry season.

Province of Bohol is classified as climatic Type IV.



Source: PAGASA 2018, *Climatological Normals (Rainfall)*, Philippine Atmospheric, Geophysical and Astronomical Services Administration (PAGASA), accessed 27 July 2018, <https://www1.pagasa.dost.gov.ph/index.php/climate/climatological-normals>.

CODE	LAND LIMITATION	CODE	LAND LIMITATION	CODE	LAND LIMITATION
1	E2-Sh2-Rc2	11	T2-E3-Rc2	21	T3-E3-Rc3
2	El2	12	T2-E3-Rc3	22	T3-E3-Sh2-Rc3
3	El2-E2-Sh2-Rc3	13	T2-E3-Sh2-Rc3	23	T3-E3-Sh3-Rc3
4	El2-E3-Rc3	14	T2-El2	24	T3-El2-E3-Rc2
5	El2-E3-Sh2-Rc3	15	T2-El2-E3-Rc3	25	T3-El2-E3-Sh2-Rc3
6	F2-D2	16	T2-El2-E3-Sh2-Rc3	26	T3-El2-E3-Sh3-Rc3
7	F3-D2	17	T2-F3-D2	27	T3-F3-D1
8	Sh2-Rc2	18	T3		
9	T2	19	T3-E3		
10	T2-E3	20	T3-E3-Rc2		

CODE	LAND USE
2	Rice paddy, non-irrigated
4	Corn
81	Coffee
82	Cacao
116	Coconut
126	Grassland
134	Shrubland, unmanaged

LAND SUITABILITY MAP FOR CACAO

LAND RESOURCES EVALUATION AND SUITABILITY ASSESSMENT OF STRATEGIC PRODUCTION AREAS

NEGROS ORIENTAL, REGION VII

EXTENT OF SUITABILITY FOR CACAO PRODUCTION BY MUNICIPALITY

MUNICIPALITY	EXISTING CACAO (Ha)			TOTAL EXISTING AREA (Ha)	EXPANSION AREA (Ha)						CONFLICT RESOLUTION (Ha)										TOTAL POTENTIAL EXPANSION AREA (Ha)
					Coconut		Shrubland, unmanaged*		Grassland, unmanaged*		Corn		Rice paddy, non-irrigated		Sugarcane		Mango		Other crops		
	S1	S2	S3		S1	S2	S1	S2	S1	S2	S1	S2	S1	S2	S1	S2	S1	S2	S1	S2	
AMLAN	-	-	-	-	778	23	-	-	9	8	1,146	5	506	2	176	-	-	-	-	-	2,653
AYUNGON	1	3	56	61	436	-	74	124	307	1,034	716	233	439	123	44	-	-	-	28	-	3,538
BACONG	-	-	-	-	5	-	176	-	-	-	281	29	32	-	1,705	13	-	-	723	-	2,965
BAIS CITY	-	-	-	-	31	18	584	51	1,422	101	3,914	177	2,058	23	252	-	-	-	32	-	8,663
BASAY	-	-	-	-	432	192	1,905	331	2,236	672	1,322	530	831	303	-	-	-	-	-	-	8,753
BINDOY	-	-	-	-	761	28	91	12	592	557	49	-	255	73	86	-	-	-	27	-	2,533
CANLAON CITY	-	-	-	-	-	-	-	-	359	-	1,646	1,736	1,235	765	67	151	-	-	-	-	5,959
CITY OF BAYAWAN	-	-	-	-	971	32	6,851	573	7,834	570	11,416	347	10,056	490	9,784	474	-	-	26	-	49,425
CITY OF GUIHULNGAN	-	-	20	20	220	446	183	448	1,021	3,167	731	1,465	665	357	29	45	-	-	20	5	9,624
CITY OF TANJAY	-	-	-	-	1,051	118	58	512	73	945	1,986	783	2,386	642	524	18	-	-	40	12	9,351
DAUIN	-	-	-	-	196	45	4	-	-	-	672	299	540	-	868	-	-	-	2,867	-	5,488
DUMAGUETE CITY	-	-	-	-	-	-	-	-	40	-	19	-	38	-	491	-	-	-	358	-	947
JIMALALUD	-	-	1	1	419	114	39	-	240	60	523	81	157	26	8	-	-	-	16	-	1,682
LA LIBERTAD	-	-	-	-	258	216	17	47	460	454	1,018	368	253	34	41	-	-	-	-	-	3,161
MABINAY	-	-	-	-	325	-	1,319	52	6,702	212	9,643	81	2,980	11	5,622	18	-	-	7	-	26,972
MANJUYOD	-	-	20	20	338	103	73	16	840	140	414	-	513	-	707	8	-	-	45	-	3,198
PAMPLONA	-	-	-	-	1,494	228	224	350	548	612	3,387	458	1,282	51	260	-	-	-	-	-	8,894
SAN JOSE	-	-	-	-	934	26	214	16	8	-	288	40	60	-	-	-	15	1	-	-	1,603
SANTA CATALINA	-	-	-	-	770	38	1,812	184	1,734	441	4,742	981	1,428	205	275	-	-	-	-	-	12,611
SIATON	-	-	-	-	1,192	35	1,061	52	2,106	467	6,610	638	3,722	78	208	16	-	-	135	2	16,321
SIBULAN	1	-	-	1	216	6	823	188	1,172	74	490	204	158	5	222	-	-	-	-	-	3,138
TAYASAN	3	-	12	15	168	3	159	1	846	129	1,095	54	640	73	82	-	-	-	8	-	3,259
VALENCIA	-	-	-	-	21	-	375	63	61	184	389	96	6	-	321	2	-	-	506	-	1,823
VALLEHERMOSO	-	-	-	-	58	28	-	-	233	609	308	414	267	90	19	9	-	-	7	5	2,044
ZAMBOANGUITA	-	-	-	-	538	68	18	31	-	11	2,635	315	2,018	7	659	-	-	-	1,727	-	8,027
TOTAL	6	3	109	**118**	11,609	1,768	15,660	3,052	29,647	10,449	55,438	9,333	32,745	3,360	22,449	753	15	1	6,367	24	**202,670**

Note: Delivery of cacao planting materials must be started on the onset of rainy season.
**establishment of shade trees prior to planting of cacao.*

SUITABILITY CLASSES:

Highly Suitable (S1)
Land having no significant limitation to sustained application of a given use, or only minor limitations that will not significantly reduce productivity or benefits and will not raise inputs above an acceptable level,

Marginally Suitable (S3)
Land having limitations which in aggregate are severe for sustained application of a given use and will so reduce productivity or benefits, or increase required inputs, that this expenditure will be only marginally justified,

Moderately Suitable (S2)
Land having limitation which in aggregate are moderately severe for sustained application of a given use; the limitation will reduce productivity or benefits and increase required inputs to the extent that the overall advantage to be gained from the use, although still attractive, will be appreciably inferior to that expected on class S1 land.

Not Suitable / Not Relevant
Land having limitations which may be surmountable in time but which cannot be corrected with existing knowledge at currently acceptable cost; the limitations are so severe as to preclude successful sustained use of the land in the given manner, Existing forest, shrubland greater than 18% slope, irrigated paddy rice and miscellaneous land types such as built up areas, roads, etc are considered as not relevant,

AGRONOMIC REQUIREMENT OF CACAO PRODUCTION

LAND UTILIZATION TYPE	SUITABILITY RATING	SLOPE (%)	SOIL DEPTH (cm)	SOIL TEXTURE	SOIL DRAINAGE	SOIL REACTION (pH)	INHERENT FERTILITY	FLOODING CLASS	EROSION CLASS	ROCK OUTCROPS	ELEVATION (masl)	ANNUAL RAINFALL (mm)	CLIMATIC TYPE
Cacao	S1	<8	>100	CL, SICL, SCL, SC, SiC, C, HC	WD,MWD	5.6 -7.2	high	none-slight	none-slight	none-few	<1000	2001-4500	I, III, IV
	S2	8 - 30	50 - 100	FSL, L, SIL	SPD,PD	5.1 - 5.5 7.3 - 7.8	medium	moderate	moderate	common	1000-1500	1000-2000	I, II
	S3	>30	<50	S, LS, CSL, SL	VPD,ED	<5,0 - > 7,9	low	severe	severe	many	>1500	<1000 >4500	

SLOPE (%)
0 - 3 - level to gently sloping
3 - 8 - gently sloping to undulating
8 - 18 - undulating to rolling
18 - 30 - rolling to moderately steep
30 - 50 - steep
> 50 - very steep

SOIL DEPTH (cm)
0 - 30 - very shallow
30 - 50 - shallow
50 - 100 - moderately deep
> 100 - deep to very deep

SOIL DRAINAGE
ED - excessively drained
WD - well drained
MWD - moderately well drained
SPD - somewhat poorly drained
PD - poorly drained
VPD - very poorly drained

SURFACE IMPEDIMENT
ROCK OUTCROPS
< 10% - none - few
10 - 30% - common
> 30% - many

SOIL REACTION (pH)
< 4,5 - extremely acid
4,5 - 5,0 - very strongly acid
5,1 - 5,5 - strongly acid
5,6 - 6,0 - medium acid
6,1 - 6,5 - slightly acid
6,6 - 7,2 - neutral
7,3 - 7,8 - mildly alkaline
7,9 - 8,4 - moderately alkaline
> 8,5 - strongly alkaline

SOIL TEXTURE
Coarse
S - sand
LS - loamy sand
CSL - coarse sandy loam
SL - sandy loam
Medium
FSL - fine sandy loam
L - loam
SIL - silt loam
CL - clay loam
SiCL - silty clay loam
SCL - sandy clay loam
Fine
SC - sandy clay
SiC - silty clay
C - clay
HC - heavy clay

CLIMATE TYPE

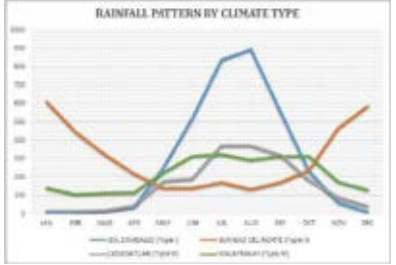
TYPE I : Two pronouced season, dry from November to April and wet during the rest of the year, Maximum rain period is from June to September

TYPE II : No dry season with a very pronounced maximum rain period from December to February, There is not a single dry month, Maximum monthly rainfall occurs during the period from March to May,

TYPE III : No very pronounced maximum rain period, with a dry season lasting only from one to three months, either during the period from December to February or from March to May, This type resembles Type I since it has a short dry season,

TYPE IV : Rainfall is more or less evenly distributed throughout the year, This type resembles Type II since it has no dry season,

Negros Oriental is classified as climatic Type III.



Source: PAGASA 2018.*Climatological Normals (Rainfall)*, Philippine Atmospheric, Geophysical and Astronomical Services Administration (PAGASA), accessed 27 July 2018, <https://www1.pagasa.dost.gov.ph/index.php/climate/climatological-normals>.

LAND LIMITATIONS DESCRIPTION AND COMBINATIONS

ELEVATION
El2 - 1000m - 1500m
El3 - > 1500m

SLOPE/TOPOGRAPHY
T2 - Undulating to moderately steep
T3 - Steep to very steep

SOIL DRAINAGE
D2 - Somewhat poorly drained to poorly drained
D3 - Very poorly drained or excessively drained

SOIL TEXTURE
Tc - Coarse texture

SOIL DEPTH
Sh2 - Moderately deep (50 - 100cm)
Sh3 - Very shallow to shallow (< 50cm)

ROCK OUTCROPS
Rc2 - Common
Rc3 - Many

SOIL EROSION
E2 - Moderate erosion
E3 - Severe erosion

FLOODING
F2 - Moderate seasonal flooding
F3 - Severe seasonal flooding

CODE	LAND LIMITATION	CODE	LAND LIMITATION	CODE	LAND LIMITATION	CODE	LAND LIMITATION	CODE	LAND LIMITATION
1	E2-Sh2-Rc2	11	F2-D2	21	T2-E3-Sh2-Rc3	31	T3-E3	41	T3-El2-E3-Sh3-Rc3
2	El2	12	F3-D2	22	T2-El2	32	T3-E3-Rc2	42	T3-El3
3	El2-E2-Sh2-Rc3	13	Rc2	23	T2-El2-E3	33	T3-E3-Sh2-Rc3	43	T3-El3-E3-Sh3-Rc2
4	El2-E3-Rc3	14	Sh2	24	T2-El2-E3-Rc2	34	T3-E3-Sh3-Rc2	44	T3-El3-E3-Sh3-Rc3
5	El2-E3-Sh2-Rc3	15	Sh2-Rc2	25	T2-El2-E3-Sh2-Rc2	35	T3-E3-Sh3-Rc3		
6	El2-Rc2	16	T2	26	T2-El2-E3-Sh2-Rc3	36	T3-El2		
7	El2-Sh2-Rc2	17	T2-E3	27	T2-El3	37	T3-El2-E3		
8	El2-Sh2-Rc3	18	T2-E3-Rc2	28	T2-El3-E3-Sh2-Rc2	38	T3-El2-E3-Rc2		
9	El3	19	T2-E3-Rc3	29	T2-F3-D2	39	T3-El2-E3-Rc3		
10	El3-Sh2-Rc2	20	T2-E3-Sh2-Rc2	30	T3	40	T3-El2-E3-Sh3-Rc2		

CODE	LAND USE	CODE	LAND USE
2	Rice paddy, non-irrigated	134	Shrubland, unmanaged
4	Corn		
34	Diversified crops		
51	Cassava		
81	Coffee		
82	Cacao		
85	Mango		
112	Sugarcane		
116	Coconut		
126	Grassland		

LAND SUITABILITY MAP FOR CACAO

LAND RESOURCES EVALUATION AND SUITABILITY ASSESSMENT OF STRATEGIC PRODUCTION AREAS

SOUTHERN LEYTE, REGION VIII

EXTENT OF SUITABILITY FOR CACAO PRODUCTION BY MUNICIPALITY

MUNICIPALITY	EXISTING CACAO (Ha)			TOTAL EXISTING AREA (Ha)	EXPANSION AREA (Ha)						CONFLICT RESOLUTION (Ha)										TOTAL POTENTIAL EXPANSION AREA (Ha)
					Coconut		Shrubland, unmanaged*		Grassland, unmanaged*		Corn		Rice paddy, non-irrigated		Sugarcane		Banana		Other crops		
	S1	S2	S3		S1	S2	S1	S2	S1	S2	S1	S2	S1	S2	S1	S2	S1	S2	S1	S2	
ANAHAWAN	-	-	-	-	1,457	-	-	-	20	1,457	-	122	-	-	-	-	-	-	-	-	3,055
BONTOC	14	-	3	17	339	-	635	178	339	-	49	155	-	103	6	-	-	16	-	6	5	1,761
CITY OF MAASIN	-	-	-	-	867	596	624	432	867	596	-	658	422	118	13	-	-	-	-	9	-	5,202
HINUNANGAN	-	-	-	-	1,063	-	775	45	1,063	-	-	393	-	639	-	-	-	-	-	-	-	3,978
HINUNDAYAN	-	-	-	-	1,855	-	44	-	1,855	-	-	248	-	229	-	-	-	-	-	183	-	4,414
LIBAGON	36	1	98	134	357	5	87	18	357	5	-	30	-	63	-	-	-	5	-	-	-	928
LILOAN	-	-	59	59	451	105	5	5	451	105	-	134	-	22	-	-	-	-	-	-	-	1,278
LIMASAWA	-	-	-	-	35	-	-	-	35	-	-	-	-	9	-	-	-	-	-	-	-	78
MACROHON	-	-	-	-	869	147	43	179	869	147	-	156	39	22	3	-	-	-	-	-	-	2,474
MALITBOG	18	3	53	74	215	49	268	300	215	49	-	95	1	63	43	-	-	1	3	2	-	1,304
PADRE BURGOS	4	20	34	58	414	91	25	57	414	91	-	11	22	2	6	-	-	-	-	-	-	1,134
PINTUYAN	-	-	-	-	281	-	135	-	281	-	-	-	-	-	1	-	-	-	-	44	-	741
SAINT BERNARD	-	-	-	-	1,019	37	269	16	1,019	37	-	306	-	90	-	-	-	-	-	-	-	2,794
SAN FRANCISCO	-	1	35	36	678	32	64	-	678	32	-	81	-	68	-	-	-	-	-	-	-	1,633
SAN JUAN (CABALIAN)	-	-	-	-	802	-	-	-	802	-	-	95	-	57	-	-	-	81	-	11	-	1,848
SAN RICARDO	-	-	7	7	327	-	3	-	327	-	-	-	-	-	-	-	-	6	-	2	-	665
SILAGO	1	-	17	19	1,550	-	1,939	299	1,550	-	-	636	-	267	-	-	-	-	-	-	-	6,241
SOGOD	-	-	-	-	914	-	389	174	914	-	-	382	-	69	-	-	-	-	-	-	-	2,841
TOMAS OPPUS	-	-	22	22	165	-	101	9	165	-	-	179	6	7	-	-	-	-	-	-	-	631
TOTAL	73	25	328	**425**	13,655	1,063	5,387	1,733	13,655	1,063	-	3,683	490	1,826	71	88	-	21	3	257	5	**43,001**

Note: Delivery of cacao planting materials must be started on the onset of rainy season.
**establishment of shade trees prior to planting of cacao.*

SUITABILITY CLASSES:

Highly Suitable (S1)
Land having no significant limitation to sustained application of a given use, or only minor limitations that will not significantly reduce productivity or benefits and will not raise inputs above an acceptable level.

Marginally Suitable (S3)
Land having limitations which in aggregate are severe for sustained application of a given use and will so reduce productivity or benefits, or increase required inputs, that this expenditure will be only marginally justified.

Moderately Suitable (S2)
Land having limitation which in aggregate are moderately severe for sustained application of a given use; the limitation will reduce productivity or benefits and increase required inputs to the extent that the overall advantage to be gained from the use, although still attractive, will be appreciably inferior to that expected on class S1 land,

Not Suitable / Not Relevant
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AGRONOMIC REQUIREMENT OF CACAO PRODUCTION

LAND UTILIZATION TYPE	SUITABILITY RATING	SLOPE (%)	SOIL DEPTH (cm)	SOIL TEXTURE	SOIL DRAINAGE	SOIL REACTION (pH)	INHERENT FERTILITY	FLOODING CLASS	EROSION CLASS	ROCK OUTCROPS	ELEVATION (masl)	ANNUAL RAINFALL (mm)	CLIMATIC TYPE
Cacao	S1	<8	>100	CL, SiCL, SCL, SC, SiC, C, HC	WD,MWD	5.6 -7.2	high	none-slight	none-slight	none-few	<1000	2001-1500	I, III, IV
	S2	8 - 30	50 - 100	FSL, L, SiL	SPD,PD	5.1 - 5.5 7.3 - 7.8	medium	moderate	moderate	common	1000-1500	1000-2000	I, II
	S3	>30	<50	S, LS, CSL, SL	VPD,ED	<5.0 - > 7.9	low	severe	severe	many	>1500	<1000 >4500	

SLOPE (%)
0 - 3 - level to gently sloping
3 - 8 - gently sloping to undulating
8 - 18 - undulating to rolling
18 - 30 - rolling to moderately steep
30 - 50 - steep
> 50 - very steep

SOIL DEPTH (cm)
0 - 30 - very shallow
30 - 50 - shallow
50 - 100 - moderately deep
> 100 - deep to very deep

SOIL DRAINAGE
ED - excessively drained
WD - well drained
MWD - moderately well drained
SPD - somewhat poorly drained
PD - poorly drained
VPD - very poorly drained

SURFACE IMPEDIMENT
ROCK OUTCROPS
< 10% - none - few
10 - 30% - common
> 30% - many

SOIL REACTION (pH)
< 4.5 - extremely acid
4.5 - 5.0 - very strongly acid
5.1 - 5.5 - strongly acid
5.6 - 6.0 - medium acid
6.1 - 6.5 - slightly acid
6.6 - 7.2 - neutral
7.3 - 7.8 - mildly alkaline
7.9 - 8.4 - moderately alkaline
> 8.5 - strongly alkaline

SOIL TEXTURE
Coarse
S - sand
LS - loamy sand
CSL - coarse sandy loam
SL - sandy loam
Medium
FSL - fine sandy loam
L - loam
SiL - silt loam
CL - clay loam
SiCL - silty clay loam
SCL - sandy clay loam
Fine
SC - sandy clay
SiC - silty clay
C - clay
HC - heavy clay

CLIMATE TYPE

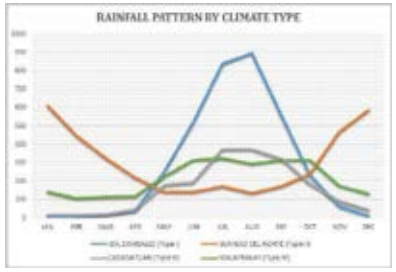
TYPE I : Two pronouced season, dry from November to April and wet during the rest of the year, Maximum rain period is from June to September

TYPE II : No dry season with a very pronounced maximum rain period from December to February. There is not a single dry month. Maximum monthly rainfall occurs during the period from March to May.

TYPE III : No very pronounced maximum rain period, with a dry season lasting only from one to three months, either during the period from December to February or from March to May, This type resembles Type I since it has a short dry season.

TYPE IV : Rainfall is more or less evenly distributed throughout the year. This type resembles Type II since it has no dry season.

Northeastern part of Southern Leyte is classified as climatic Type II and Norwestern part is Type IV.



Source: PAGASA 2018, *Climatological Normals (Rainfall)*, Philippine Atmospheric, Geophysical and Astronomical Services Administration (PAGASA), accessed 27 July 2018. <https://www1.pagasa.dost.gov.ph/index.php/climate/climatological-normals>.

LAND LIMITATIONS DESCRIPTION AND COMBINATIONS

ELEVATION
El2 - 1000m - 1500m
El3 - > 1500m

SLOPE/TOPOGRAPHY
T2 - Undulating to moderately steep
T3 - Steep to very steep

SOIL DRAINAGE
D2 - Somewhat poorly drained to poorly drained
D3 - Very poorly drained or excessively drained

SOIL TEXTURE
Tc - Coarse texture

SOIL DEPTH
Sh2 - Moderately deep (50 - 100cm)
Sh3 - Very shallow to shallow (< 50cm)

ROCK OUTCROPS
Rc2 - Common
Rc3 - Many

SOIL EROSION
E2 - Moderate erosion
E3 - Severe erosion

FLOODING
F2 - Moderate seasonal flooding
F3 - Severe seasonal flooding

CODE	LAND LIMITATION	CODE	LAND LIMITATION
15	T2-E3-Sh2-Rc3	25	T3-E3-Rc2
16	T2-El2	26	T3-E3-Rc3
17	T2-El2-E3	27	T3-E3-Sh3-Rc2
18	T2-El2-E3-Rc2	28	T3-E3-Sh3-Rc3
19	T2-El2-E3-Sh2-Rc2	29	T3-El2
20	T2-El2-E3-Sh2-Rc3	30	T3-El2-E3
21	T2-F2-D1	31	T3-El2-E3-Rc2
22	T2-F3-D1	32	T3-El2-E3-Sh3-Rc2
23	T3	33	T3-El2-E3-Sh3-Rc3
24	T3-E3	34	Tc

CODE	LAND USE	CODE	LAND USE
2	Rice paddy, non-irrigated	112	Sugarcane
4	Corn	116	Coconut
34	Diversified crops	126	Grassland
81	Coffee	134	Shrubland, unmanaged
82	Cacao		
85	Mango		
87	Jackfruit		
91	Banana		
105	Fruit trees, mixed		
107	Abaca		

LAND SUITABILITY MAP FOR CACAO

LAND RESOURCES EVALUATION AND SUITABILITY ASSESSMENT OF STRATEGIC PRODUCTION AREAS

CITY OF ISABELA, REGION IX

EXTENT OF SUITABILITY FOR CACAO PRODUCTION BY MUNICIPALITY

MUNICIPALITY	EXISTING CACAO (Ha)			TOTAL EXISTING AREA (Ha)	EXPANSION AREA (Ha)						CONFLICT RESOLUTION AREA (Ha)						TOTAL POTENTIAL EXPANSION AREA (Ha)
					Coconut		Shrubland, unmanaged*		Grassland, unmanaged*		Corn		Paddy rice, non-irrigated		Other crops		
	S1	S2	S3		S1	S2	S1	S2	S1	S2	S1	S2	S1	S2	S1	S2	
CITY OF ISABELA	-	-	-	-	11,428	958	195	24	-	-	-	-	-	-	-	-	12,604
	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TOTAL	-	-	-	-	11,428	958	195	24	-	-	-	-	-	-	-	-	**12,604**

Note: Delivery of cacao planting materials must be started on the onset of rainy season.
**establishment of shade trees prior to planting of cacao.*

SUITABILITY CLASSES:

Highly Suitable (S1)
Land having no significant limitation to sustained application of a given use, or only minor limitations that will not significantly reduce productivity or benefits and will not raise inputs above an acceptable level.

Marginally Suitable (S3)
Land having limitations which in aggregate are severe for sustained application of a given use and will so reduce productivity or benefits, or increase required inputs, that this expenditure will be only marginally justified.

Moderately Suitable (S2)
Land having limitation which in aggregate are moderately severe for sustained application of a given use; the limitation will reduce productivity or benefits and increase required inputs to the extent that the overall advantage to be gained from the use, although still attractive, will be appreciably inferior to that expected on class S1 land,

Not Suitable / Not Relevant
Land having limitations which may be surmountable in time but which cannot be corrected with existing knowledge at currently acceptable cost; the limitations are so severe as to preclude successful sustained use of the land in the given manner. Existing forest, shrubland greater than 18% slope, irrigated paddy rice and miscellaneous land types such as built up areas, roads, etc are considered as not relevant.

AGRONOMIC REQUIREMENT OF CACAO PRODUCTION

LAND UTILIZATION TYPE	SUITABILITY RATING	SLOPE (%)	SOIL DEPTH (cm)	SOIL TEXTURE	SOIL DRAINAGE	SOIL REACTION (pH)	INHERENT FERTILITY	FLOODING CLASS	EROSION CLASS	ROCK OUTCROPS	ELEVATION (masl)	ANNUAL RAINFALL (mm)	CLIMATIC TYPE
Cacao	S1	<8	>100	CL, SiCL, SCL, SC, SiC, C, HC	WD,MWD	5,6 -7,2	high	none-slight	none-slight	none-few	<1000	2001-4500	I, III, IV
	S2	8 - 30	50 - 100	FSL, L, SiL	SPD,PD	5.1 - 5.5 7.3 - 7.8	medium	moderate	moderate	common	1000-1500	1000-2000	I, II
	S3	>30	<50	S, LS, CSL, SL	VPD,ED	<5.0 - > 7,9	low	severe	severe	many	>1500	<1000 >4500	

SLOPE (%)
0 - 3 - level to gently sloping
3 - 8 - gently sloping to undulating
8 - 18 - undulating to rolling
18 - 30 - rolling to moderately steep
30 - 50 - steep
> 50 - very steep

SOIL DEPTH (cm)
0 - 30 - very shallow
30 - 50 - shallow
50 - 100 - moderately deep
> 100 - deep to very deep

SOIL DRAINAGE
ED - excessively drained
WD - well drained
MWD - moderately well drained
SPD - somewhat poorly drained
PD - poorly drained
VPD - very poorly drained

SURFACE IMPEDIMENT
ROCK OUTCROPS
< 10% - none - few
10 - 30% - common
> 30% - many

SOIL REACTION (pH)
< 4.5 - extremely acid
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6.1 - 6.5 - slightly acid
6.6 - 7.2 - neutral
7.3 - 7.8 - mildly alkaline
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SOIL TEXTURE
Coarse
S - sand
LS - loamy sand
CSL - coarse sandy loam
SL - sandy loam
Medium
FSL - fine sandy loam
L - loam
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CL - clay loam
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LAND LIMITATIONS DESCRIPTION AND COMBINATIONS

ELEVATION
El2 - 1000m - 1500m
El3 - > 1500m

SLOPE/TOPOGRAPHY
T2 - Undulating to moderately steep
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SOIL DRAINAGE
D2 - Somewhat poorly drained to poorly drained
D3 - Very poorly drained or excessively drained

SOIL TEXTURE
Tc - Coarse texture

SOIL DEPTH
Sh2 - Moderately deep (50 - 100cm)
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ROCK OUTCROPS
Rc2 - Common
Rc3 - Many

SOIL EROSION
E2 - Moderate erosion
E3 - Severe erosion

FLOODING
F2 - Moderate seasonal flooding
F3 - Severe seasonal flooding

CODE	LIMITATION	CODE	LIMITATION
1	E2-Sh2-Rc2	11	T2-E3-Sh2-Rc3
2	El2	12	T2-El2-E3-Sh2-Rc2
3	El2-E3-Sh2-Rc3	13	T2-El2-E3-Sh2-Rc3
4	El2-Sh2-Rc2	14	T3-E3
5	F2-D2	15	T3-E3-Sh3-Rc3
6	F2-Tc	16	T3-El2-E3-Sh3-Rc2
7	F3-D2	17	T3-El2-E3-Sh3-Rc3
8	Sh2-Rc2	18	T3-E3-Sh3-Rc3
9	T2	19	T3-El2-E3-Sh3-Rc3
10	T2-E3		

CODE	LANDUSE
85	Mango
116	Coconut
134	Shrubs, unmanaged
137	Rubber

CLIMATE TYPE

TYPE I : Two pronouced season, dry from November to April and wet during the rest of the year. Maximum rain period is from June to September

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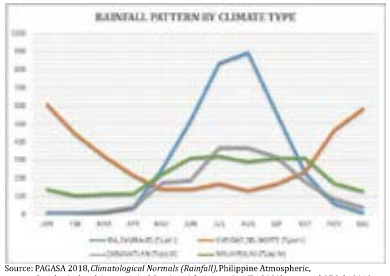
TYPE IV : Rainfall is more or less evenly distributed throughout the year. This type resembles Type II since it has no dry season.

Whole part of City of Isabela is classified as climatic Type IV.



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LAND SUITABILITY MAP FOR CACAO

LAND RESOURCES EVALUATION AND SUITABILITY ASSESSMENT OF STRATEGIC PRODUCTION AREAS

ZAMBOANGA CITY, REGION IX

EXTENT OF SUITABILITY FOR CACAO PRODUCTION BY MUNICIPALITY

MUNICIPALITY	EXISTING CACAO (Ha)			TOTAL EXISTING AREA (Ha)	EXPANSION AREA (Ha)						CONFLICT RESOLUTION AREA (Ha)						TOTAL POTENTIAL EXPANSION AREA (Ha)
					Coconut		Shrubland, unmanaged*		Grassland, unmanaged*		Corn		Paddy rice, non-irrigated		Other crops		
	S1	S2	S3		S1	S2	S1	S2	S1	S2	S1	S2	S1	S2	S1	S2	
ZAMBOANGA CITY	-	-	-	-	17,783	2,221	3,742	702	10,589	1,677	3,208	20	-	-	-	8	39,949
TOTAL	-	-	-	-	17,783	2,221	3,742	702	10,589	1,677	3,208	20	-	-	-	8	39,949

Note: Delivery of cacao planting materials must be started on the onset of rainy season.
**establishment of shade trees prior to planting of cacao.*

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AGRONOMIC REQUIREMENT OF CACAO PRODUCTION

LAND UTILIZATION TYPE	SUITABILITY RATING	SLOPE (%)	SOIL DEPTH (cm)	SOIL TEXTURE	SOIL DRAINAGE	SOIL REACTION (pH)	INHERENT FERTILITY	FLOODING CLASS	EROSION CLASS	ROCK OUTCROPS	ELEVATION (masl)	ANNUAL RAINFALL (mm)	CLIMATIC TYPE
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	S2	8 - 30	50 - 100	FSL, L, SiL	SPD,PD	5.1 - 5.5 7.3 - 7.8	medium	moderate	moderate	common	1000-1500	1000-2000	I, II
	S3	>30	<50	S, LS, CSL, SL	VPD,ED	<5.0 - > 7.9	low	severe	severe	many	>1500	<1000 >4500	

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SURFACE IMPEDIMENT
ROCK OUTCROPS
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SiC - silty clay
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CLIMATE TYPE

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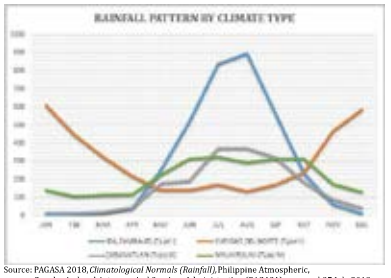
TYPE IV : Rainfall is more or less evenly distributed throughout the year. This type resembles Type II since it has no dry season.

Whole part of Zamboanga City is classified as climatic Type III.



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LAND LIMITATIONS DESCRIPTION AND COMBINATIONS

ELEVATION
EI2 - 1000m - 1500m
EI3 - > 1500m

SLOPE/TOPOGRAPHY
T2 - Undulating to moderately steep
T3 - Steep to very steep

SOIL DRAINAGE
D2 - Somewhat poorly drained to poorly drained
D3 - Very poorly drained or excessively drained

SOIL TEXTURE
Tc - Coarse texture

SOIL DEPTH
Sh2 - Moderately deep (50 - 100cm)
Sh3 - Very shallow to shallow (< 50cm)

ROCK OUTCROPS
Rc2 - Common
Rc3 - Many

SOIL EROSION
E2 - Moderate erosion
E3 - Severe erosion

FLOODING
F2 - Moderate seasonal flooding
F3 - Severe seasonal flooding

CODE	LIMITATION	CODE	LIMITATION	CODE	LIMITATION	CODE	LIMITATION
1	E2-Sh2-Rc2	11	T2-E3	21	T2-F3-D2	31	T3-EI2-E3-Sh3-Rc3
2	EI2	12	T2-E3-Rc2	22	T3	32	T3-F3-D2
3	EI2-E2-Rc3	13	T2-E3-Rc3	23	T3-F3	33	T3
4	EI2-E3-Rc3	14	T2-E3-Sh2-Rc2	24	T3-E3-Rc2	34	T3-E3
5	EI2-Sh2-Rc2	15	T2-E3-Sh2-Rc3	25	T3-E3-Sh2-Rc3	35	T3-E3-Rc3
6	EI2-Sh2-Rc3	16	T2-EI2-E3	26	T3-E3-Sh3-Rc2	36	T3-E3-Sh3-Rc3
7	F2-D2	17	T2-EI2-E3-Rc3	27	T3-E3-Sh3-Rc3	37	T3-EI2-E3-Sh3-Rc3
8	F3-D2	18	T2-EI2-E3-Sh2-Rc2	28	T3-EI2-E3	38	T3-EI3
9	Sh2-Rc2	19	T2-EI2-E3-Sh2-Rc3	29	T3-EI2-E3-Sh2-Rc3	39	Tc
10	T2	20	T2-F2-D2	30	T3-EI2-E3-Sh3-Rc2		

CODE	LANDUSE
4	Corn
82	Cacao
105	Fruit trees, mixed
116	Coconut
126	Grassland
134	Shrubs, unmanaged
137	Rubber

LAND SUITABILITY MAP FOR CACAO

LAND RESOURCES EVALUATION AND SUITABILITY ASSESSMENT OF STRATEGIC PRODUCTION AREAS

ZAMBOANGA DEL NORTE, REGION IX

EXTENT OF SUITABILITY FOR CACAO PRODUCTION BY MUNICIPALITY

MUNICIPALITY	EXISTING CACAO (Ha)			TOTAL EXISTING AREA (Ha)	EXPANSION AREA (Ha)						CONFLICT RESOLUTION AREA (Ha)						TOTAL POTENTIAL EXPANSION AREA (Ha)
					Coconut		Shrubland, unmanaged*		Grassland, unmanaged*		Corn		Paddy rice, non-irrigated		Other crops		
	S1	S2	S3		S1	S2	S1	S2	S1	S2	S1	S2	S1	S2	S1	S2	
BACUNGAN	10	1	33	44	2,518	31	55	6	900	28	160	-	-	-	-	-	3,699
BALIGUIAN	17	18	87	122	1,612	596	278	13	175	465	119	-	-	-	-	-	3,257
DAPITAN CITY	-	-	-	-	6,398	1,583	649	14	50	83	45	25	-	-	-	-	8,846
DIPOLOG CITY	-	-	-	-	5,695	11	144	-	83	-	921	-	-	-	-	-	6,853
GODOD	34	1	22	57	3,042	1,758	3,273	65	897	65	359	32	-	-	-	-	9,492
GUTALAC	14	18	21	53	3,319	8,181	87	57	305	1,769	30	67	-	-	-	-	13,813
JOSE DALMAN	-	2	3	5	2,815	436	56	86	563	209	557	1	-	-	-	-	4,725
KALAWIT	39	19	10	68	842	10,183	-	31	65	1,182	128	2,607	-	-	-	-	15,039
KATIPUNAN	-	-	11	11	5,156	5	1,357	-	369	-	389	-	-	-	-	-	7,275
LA LIBERTAD	-	-	-	-	1,367	2,600	-	-	2	90	133	50	-	-	-	-	4,242
LABASON	14	9	7	30	631	4,630	-	20	17	1,729	4	132	-	-	-	-	7,162
LILOY	-	-	-	-	2,382	2,660	-	-	106	205	2,738	2,164	-	-	-	-	10,254
MANUKAN	1	-	17	17	3,047	91	82	-	759	78	357	-	-	-	-	-	4,414
MUTIA	-	3	1	4	1,297	2,723	-	194	281	871	43	9	-	-	-	-	5,417
PIÑAN	-	-	1	1	6,876	2,159	154	30	654	93	155	-	-	-	-	-	10,121
POLANCO	3	-	4	7	8,457	321	257	3	733	64	1,751	1	-	-	3	-	11,589
PRES. MANUEL A. ROXAS	-	-	12	12	607	-	8	-	226	-	3,659	-	-	-	-	-	4,499
RIZAL	-	-	1	1	2,869	1,237	-	-	88	-	83	-	-	-	-	-	4,277
SALUG	14	1	2	17	5,832	1,476	69	198	1,032	96	698	101	-	-	-	-	9,503
SERGIO OSMEÑA SR.	11	-	17	28	3,345	872	168	156	1,118	142	118	124	-	-	-	-	6,042
SIAYAN	10	-	40	50	1,097	369	150	354	4,775	991	376	19	-	-	-	-	8,131
SIBUCO	-	-	4	4	2,645	560	783	14	3,659	529	125	-	-	-	-	-	8,315
SIBUTAD	-	-	-	-	2,910	-	141	-	122	-	94	-	-	-	-	-	3,267
SINDANGAN	6	-	40	46	4,619	926	286	578	2,314	1,550	2,353	45	-	-	-	-	12,671
SIOCON	26	-	30	56	5,048	34	495	-	1,402	85	823	-	-	-	-	-	7,887
SIRAWAI	-	-	-	-	4,223	303	378	4	610	101	353	-	-	-	-	-	5,972
TAMPILISAN	13	5	1	19	278	5,941	-	38	63	386	414	2,881	-	-	-	-	10,001
TOTAL	211	76	365	**652**	88,927	49,685	8,869	1,862	21,368	10,810	16,983	8,257	-	-	3	-	**206,764**

Note: Delivery of cacao planting materials must be started on the onset of rainy season.
**establishment of shade trees prior to planting of cacao.*

AGRONOMIC REQUIREMENT OF CACAO PRODUCTION

LAND UTILIZATION TYPE	SUITABILITY RATING	SLOPE (%)	SOIL DEPTH (cm)	SOIL TEXTURE	SOIL DRAINAGE	SOIL REACTION (pH)	INHERENT FERTILITY	FLOODING CLASS	EROSION CLASS	ROCK OUTCROPS	ELEVATION (masl)	ANNUAL RAINFALL (mm)	CLIMATIC TYPE
Cacao	S1	<8	>100	CL, SiCL, SCL, SC, SiC, C, HC	WD,MWD	5.6 - 7.2	high	none-slight	none-slight	none-few	<1000	2001-4500	I, III, IV
	S2	8 - 30	50 - 100	FSL, L, SiL	SPD,PD	5.1 - 5.5 7.3 - 7.8	medium	moderate	moderate	common	1000-1500	1000-2000	I, II
	S3	>30	<50	S, LS, CSL, SL	VPD,ED	<5.0 - > 7.9	low	severe	severe	many	>1500	<1000 >4500	

SLOPE (%)
0 - 3 - level to gently sloping
3 - 8 - gently sloping to undulating
8 - 18 - undulating to rolling
18 - 30 - rolling to moderately steep
30 - 50 - steep
> 50 - very steep

SOIL DEPTH (cm)
0 - 30 - very shallow
30 - 50 - shallow
50 - 100 - moderately deep
> 100 - deep to very deep

SOIL DRAINAGE
ED - excessively drained
WD - well drained
MWD - moderately well drained
SPD - somewhat poorly drained
PD - poorly drained
VPD - very poorly drained

SURFACE IMPEDIMENT
ROCK OUTCROPS
< 10% - none - few
10 - 30% - common
> 30% - many

SOIL REACTION (pH)
< 4.5 - extremely acid
4.5 - 5.0 - very strongly acid
5.1 - 5.5 - strongly acid
5.6 - 6.0 - medium acid
6.1 - 6.5 - slightly acid
6.6 - 7.2 - neutral
7.3 - 7.8 - mildly alkaline
7.9 - 8.4 - moderately alkaline
> 8.5 - strongly alkaline

SOIL TEXTURE
Coarse
S - sand
LS - loamy sand
CSL - coarse sandy loam
SL - sandy loam
Medium
FSL - fine sandy loam
L - loam
SiL - silt loam
CL - clay loam
SiCL - silty clay loam
SCL - sandy clay loam
Fine
SC - sandy clay
SiC - silty clay
C - clay
HC - heavy clay

LAND LIMITATIONS DESCRIPTION AND COMBINATIONS

ELEVATION
El2 - 1000m - 1500m
El3 - > 1500m

SLOPE/TOPOGRAPHY
T2 - Undulating to moderately steep
T3 - Steep to very steep

SOIL DRAINAGE
D2 - Somewhat poorly drained to poorly drained
D3 - Very poorly drained or excessively drained

SOIL TEXTURE
Tc - Coarse texture

SOIL DEPTH
Sh2 - Moderately deep (50 - 100cm)
Sh3 - Very shallow to shallow (< 50cm)

ROCK OUTCROPS
Rc2 - Common
Rc3 - Many

SOIL EROSION
E2 - Moderate erosion
E3 - Severe erosion

FLOODING
F2 - Moderate seasonal flooding
F3 - Severe seasonal flooding

CODE	LIMITATION	CODE	LIMITATION	CODE	LIMITATION	CODE	LIMITATION	CODE	LIMITATION
1	E2-Sh2-Rc2	11	F3-D2	21	T2-El2-E3	31	T3-E3-Sh3-Rc2	41	T3-E3
2	El2	12	Sh2	22	T2-El2-E3-Rc3	32	T3-E3-Sh3-Rc3	42	T3-E3-Rc3
3	El2-E2-Rc3	13	Sh2-Rc2	23	T2-El2-E3-Sh2-Rc2	33	T3-El2	43	T3-E3-Sh3-Rc3
4	El2-E2-Sh2-Rc3	14	T2	24	T2-El2-E3-Sh2-Rc3	34	T3-El2-E3	44	T3-El2
5	El2-E3-Rc3	15	T2-E3	25	T2-F2-D2	35	T3-El2-E3-Sh2-Rc3	45	T3-El2-E3
6	El2-E3-Sh2-Rc3	16	T2-E3-Rc2	26	T2-F3-D2	36	T3-El2-E3-Sh3-Rc2	46	T3-El2-E3-Sh2-Rc3
7	El2-Rc2	17	T2-E3-Rc3	27	T3	37	T3-El2-E3-Sh3-Rc3	47	T3-F3-D2
8	El2-Sh2-Rc2	18	T2-E3-Sh2-Rc2	28	T3-E3	38	T3-F2-D2	48	T3-El3
9	El2-Sh2-Rc3	19	T2-E3-Sh2-Rc3	29	T3-El3-Rc2	39	T3-F3-D2	49	Tc
10	F2-D2	20	T2-El2	30	T3-El3-Sh2-Rc3	40	T3		

CODE	LANDUSE
4	Corn
81	Coffee
82	Cacao
115	Mixed crops
116	Coconut
126	Grassland
134	Shrubs, unmanaged
137	Rubber

SUITABILITY CLASSES:

Highly Suitable (S1)
Land having no significant limitation to sustained application of a given use, or only minor limitations that will not significantly reduce productivity or benefits and will not raise inputs above an acceptable level.

Moderately Suitable (S2)
Land having limitation which in aggregate are moderately severe for sustained application of a given use; the limitation will reduce productivity or benefits and increase required inputs to the extent that the overall advantage to be gained from the use, although still attractive, will be appreciably inferior to that expected on class S1 land.

Marginally Suitable (S3)
Land having limitations which in aggregate are severe for sustained application of a given use and will so reduce productivity or benefits, or increase required inputs, that this expenditure will be only marginally justified.

Not Suitable / Not Relevant
Land having limitations which may be surmountable in time but which cannot be corrected with existing knowledge at currently acceptable cost; the limitations are so severe as to preclude successful sustained use of the land in the given manner. Existing forest, shrubland greater than 18% slope, irrigated paddy rice and miscellaneous land types such as built up areas, roads, etc are considered as not relevant.

CLIMATE TYPE

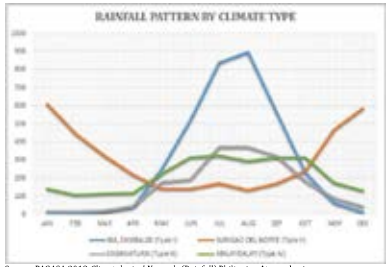
TYPE I : Two pronouced season, dry from November to April and wet during the rest of the year. Maximum rain period is from June to September

TYPE II : No dry season with a very pronounced maximum rain period from December to February. There is not a single dry month. Maximum monthly rainfall occurs during the period from March to May.

TYPE III : No very pronounced maximum rain period, with a dry season lasting only from one to three months, either during the period from December to February or from March to May. This type resembles Type I since it has a short dry season.

TYPE IV : Rainfall is more or less evenly distributed throughout the year. This type resembles Type II since it has no dry season.

Northeastern part of Zamboaga Del Norte is classified as climatic Type IV and Northwestern part is Type III.



Source: PAGASA 2018, *Climatological Normals (Rainfall)*, Philippine Atmospheric, Geophysical and Astronomical Services Administration (PAGASA), accessed 27 July 2018, <https://www1.pagasa.dost.gov.ph/index.php/climate/climatological-normals>.

LAND SUITABILITY MAP FOR CACAO

LAND RESOURCES EVALUATION AND SUITABILITY ASSESSMENT OF STRATEGIC PRODUCTION AREAS

ZAMBOANGA DEL SUR, REGION IX

EXTENT OF SUITABILITY FOR CACAO PRODUCTION BY MUNICIPALITY

MUNICIPALITY	EXISTING CACAO (Ha)			TOTAL EXISTING AREA (Ha)	EXPANSION AREA (Ha)						CONFLICT RESOLUTION AREA (Ha)								TOTAL POTENTIAL EXPANSION AREA (Ha)
					Coconut		Shrubland, unmanaged*		Grassland, unmanaged*		Corn		Mango		Banana		Other crops		
	S1	S2	S3		S1	S2	S1	S2	S1	S2	S1	S2	S1	S2	S1	S2	S1	S2	
AURORA	1	-	-	1	6,887	1,118	100	7	287	92	1,119	67	-	-	-	-	-	-	9,676
BAYOG	1	-	8	8	667	-	234	15	3,430	260	1,070	-	-	-	-	-	-	-	5,675
DIMATALING	4	1	6	10	5,214	350	288	2	-	-	441	-	8	-	-	-	-	-	6,303
DINAS	-	-	-	-	8,515	-	241	-	144	-	1,385	-	6	-	-	-	5	-	10,296
DUMALINAO	1	37	-	38	3,594	3	9	-	403	-	2,856	103	-	-	-	-	-	-	6,969
DUMINGAG	1	-	19	19	282	-	133	-	7,764	85	1,228	-	-	-	-	-	-	-	9,491
GUIPOS	-	-	-	-	953	19	8	1	430	-	2,380	-	-	-	-	-	-	-	3,791
JOSEFINA	-	-	-	-	685	702	7	162	-	135	630	1,167	-	-	-	-	-	-	3,488
KUMALARANG	-	-	-	-	1,994	103	10	-	128	134	988	-	-	-	-	-	-	-	3,359
LABANGAN	5	3	-	8	204	-	18	-	1,640	-	2,620	-	-	-	-	-	1	-	4,483
LAKEWOOD	-	-	-	-	2,208	15	126	2	818	59	541	-	-	-	-	-	3	-	3,771
LAPUYAN	-	-	-	-	7,241	120	413	-	190	-	1,155	-	-	-	-	-	-	-	9,120
MAHAYAG	-	-	-	-	2,461	-	127	-	656	16	2,649	-	-	-	9	-	2	-	5,920
MARGOSATUBIG	-	-	-	-	4,285	1	191	-	24	-	514	-	-	-	-	-	-	-	5,015
MIDSALIP	-	-	-	-	49	20	154	-	3,967	182	850	46	-	-	-	-	-	-	5,268
MOLAVE	-	-	-	-	1,877	43	272	-	1	-	3,964	86	-	-	-	-	-	-	6,243
PAGADIAN CITY	-	-	-	-	4,290	29	295	3	976	17	4,245	410	-	-	-	-	-	-	10,174
PITOGO	-	-	-	-	3,432	2,292	-	-	-	-	241	37	-	-	-	-	-	-	6,001
RAMON MAGSAYSAY	-	-	-	-	4,093	-	49	-	445	-	1,351	-	-	-	-	-	-	-	5,938
SAN MIGUEL	1	-	2	3	4,052	6	113	-	136	-	1,186	-	-	-	-	-	-	-	5,494
SAN PABLO	-	-	-	-	4,523	-	-	-	28	-	991	-	2	-	-	-	-	-	5,545
SOMINOT	-	-	-	-	1,594	128	68	-	2,569	70	607	35	-	-	-	-	-	-	5,070
TABINA	-	-	-	-	1,111	4,581	-	-	-	-	8	65	-	-	-	2	5	-	5,771
TAMBULIG	-	-	1	1	2,690	-	1	-	66	-	2,288	-	-	-	-	-	-	-	5,046
TIGBAO	-	-	-	-	1,659	60	72	19	157	16	1,170	6	1	-	-	-	3	-	3,162
TUKURAN	-	-	-	-	447	-	107	-	3,617	29	1,043	-	-	-	3	-	-	-	5,245
VINCENZO A. SAGUN	6	-	7	12	4,285	-	-	-	25	-	149	-	1	-	-	-	-	-	4,460
TOTAL	17	42	42	**101**	79,292	9,590	2,944	211	27,901	1,095	37,669	2,022	17	-	11	2	20	-	**160,775**

Note: Delivery of cacao planting materials must be started on the onset of rainy season.
**establishment of shade trees prior to planting of cacao.*

AGRONOMIC REQUIREMENT OF CACAO PRODUCTION

LAND UTILIZATION TYPE	SUITABILITY RATING	SLOPE (%)	SOIL DEPTH (cm)	SOIL TEXTURE	SOIL DRAINAGE	SOIL REACTION (pH)	INHERENT FERTILITY	FLOODING CLASS	EROSION CLASS	ROCK OUTCROPS	ELEVATION (masl)	ANNUAL RAINFALL (mm)	CLIMATIC TYPE
Cacao	S1	<8	>100	CL, SiCL, SCL, SC, SiC, C, HC	WD,MWD	5.6 -7.2	high	none-slight	none-slight	none-few	<1000	2001-4500	I, III, IV
	S2	8 - 30	50 - 100	FSL, L, SiL	SPD,PD	5.1 - 5.5 7.3 - 7.8	medium	moderate	moderate	common	1000-1500	1000-2000	I, II
	S3	>30	<50	S, LS, CSL, SL	VPD,ED	<5.0 - > 7.9	low	severe	severe	many	>1500	<1000 >4500	

SLOPE (%)
0 - 3 - level to gently sloping
3 - 8 - gently sloping to undulating
8 - 18 - undulating to rolling
18 - 30 - rolling to moderately steep
30 - 50 - steep
> 50 - very steep

SOIL DRAINAGE
ED - excessively drained
WD - well drained
MWD - moderately well drained
SPD - somewhat poorly drained
PD - poorly drained
VPD - very poorly drained

SOIL REACTION (pH)
< 4.5 - extremely acid
4.5 - 5.0 - very strongly acid
5.1 - 5.5 - strongly acid
5.6 - 6.0 - medium acid
6.1 - 6.5 - slightly acid
6.6 - 7.2 - neutral
7.3 - 7.8 - mildly alkaline
7.9 - 8.4 - moderately alkaline
> 8.5 - strongly alkaline

SOIL TEXTURE
Coarse
S - sand
LS - loamy sand
CSL - coarse sandy loam
SL - sandy loam
Medium
FSL - fine sandy loam
L - loam
SiL - silt loam
CL - clay loam
SiCL - silty clay loam
SCL - sandy clay loam
Fine
SC - sandy clay
SiC - silty clay
C - clay
HC - heavy clay

SOIL DEPTH (cm)
0 - 30 - very shallow
30 - 50 - shallow
50 - 100 - moderately deep
> 100 - deep to very deep

SURFACE IMPEDIMENT
ROCK OUTCROPS
< 10% - none - few
10 - 30% - common
> 30% - many

LAND LIMITATIONS DESCRIPTION AND COMBINATIONS

ELEVATION
El2 - 1000m - 1500m
El3 - > 1500m

SOIL DRAINAGE
D2 - Somewhat poorly drained to poorly drained
D3 - Very poorly drained or excessively drained

SOIL DEPTH
Sh2 - Moderately deep (50 - 100cm)
Sh3 - Very shallow to shallow (< 50cm)

SOIL EROSION
E2 - Moderate erosion
E3 - Severe erosion

SLOPE/TOPOGRAPHY
T2 - Undulating to moderately steep
T3 - Steep to very steep

SOIL TEXTURE
Tc - Coarse texture

ROCK OUTCROPS
Rc2 - Common
Rc3 - Many

FLOODING
F2 - Moderate seasonal flooding
F3 - Severe seasonal flooding

CODE	LIMITATION	CODE	LIMITATION	CODE	LIMITATION	CODE	LIMITATION	CODE	LIMITATION
1	E2-Sh2-Rc2	11	T2	21	T2-El2-E3-Sh2-Rc3	31	T3-El2-E3-Rc2	41	T3-El2-E3
2	El2	12	T2-E3	22	T2-F2-D2	32	T3-El2-E3-Sh3-Rc2	42	T3-El2-E3-Sh3-Rc3
3	El2-E3-Sh2-Rc3	13	T2-E3-Rc2	23	T2-F3-D2	33	T3-El2-E3-Sh3-Rc3	43	T3-El4
4	El2-Rc2	14	T2-E3-Rc3	24	T3	34	T3-El3-E3-Sh3-Rc3		
5	El2-Sh2-Rc2	15	T2-E3-Sh2-Rc2	25	T3-E3	35	T3-F2-D2		
6	El2-Sh2-Rc3	16	T2-E3-Sh2-Rc3	26	T3-E3-Sh2-Rc3	36	T3-F3-D2		
7	F2-D2	17	T2-El2	27	T3-E3-Sh3-Rc2	37	T3		
8	F2-Tc	18	T2-El2-E3	28	T3-E3-Sh3-Rc3	38	T3-E3		
9	F3-D2	19	T2-El2-E3-Rc2	29	T3-El2	39	T3-E3-Sh3-Rc3		
10	Sh2-Rc2	20	T2-El2-E3-Sh2-Rc2	30	T3-El2-E3	40	T3-El2		

CODE	LANDUSE	CODE	LANDUSE
4	Corn	131	Ipil ipil
47	Vegetable	134	Shrubs, unmanaged
81	Coffee	137	Rubber
82	Cacao		
85	Mango		
87	Jackfruit		
91	Banana		
105	Fruit trees, mixed		
116	Coconut		
126	Grassland		

SUITABILITY CLASSES:

Highly Suitable (S1)
Land having no significant limitation to sustained application of a given use, or only minor limitations that will not significantly reduce productivity or benefits and will not raise inputs above an acceptable level.

Marginally Suitable (S3)
Land having limitations which in aggregate are severe for sustained application of a given use and will so reduce productivity or benefits, or increase required inputs, that this expenditure will be only marginally justified.

Moderately Suitable (S2)
Land having limitation which in aggregate are moderately severe for sustained application of a given use; the limitation will reduce productivity or benefits and increase required inputs to the extent that the overall advantage to be gained from the use, although still attractive, will be appreciably inferior to that expected on class S1 land.

Not Suitable / Not Relevant
Land having limitations which may be surmountable in time but which cannot be corrected with existing knowledge at currently acceptable cost; the limitations are so severe as to preclude successful sustained use of the land in the given manner. Existing forest, shrubland greater than 18% slope, irrigated paddy rice and miscellaneous land types such as built up areas, roads, etc are considered as not relevant.

CLIMATE TYPE

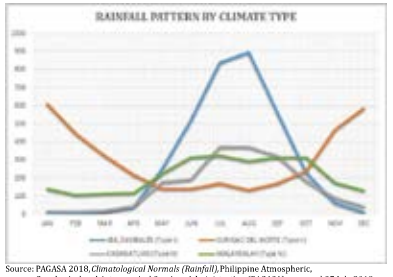
TYPE I : Two pronounced season, dry from November to April and wet during the rest of the year. Maximum rain period is from June to September

TYPE II : No dry season with a very pronounced maximum rain period from December to February. There is not a single dry month. Maximum monthly rainfall occurs during the period from March to May.

TYPE III : No very pronounced maximum rain period, with a dry season lasting only from one to three months, either during the period from December to February or from March to May. This type resembles Type I since it has a short dry season.

TYPE IV : Rainfall is more or less evenly distributed throughout the year. This type resembles Type II since it has no dry season.

Eastern part of Zamboanga Del Sur belongs to Type III climate classification and the rest on Wesstern part belongs to Type IV.



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LAND SUITABILITY MAP FOR CACAO

LAND RESOURCES EVALUATION AND SUITABILITY ASSESSMENT OF STRATEGIC PRODUCTION AREAS

ZAMBOANGA SIBUGAY, REGION IX

EXTENT OF SUITABILITY FOR CACAO PRODUCTION BY MUNICIPALITY

MUNICIPALITY	EXISTING CACAO (Ha)			TOTAL EXISTING AREA (Ha)	EXPANSION AREA (Ha)						CONFLICT RESOLUTION AREA (Ha)						TOTAL POTENTIAL EXPANSION AREA (Ha)
					Coconut		Shrubland, unmanaged*		Grassland, unmanaged*		Corn		Paddy rice, non-irrigated		Other crops		
	S1	S2	S3		S1	S2	S1	S2	S1	S2	S1	S2	S1	S2	S1	S2	
ALICIA	8	-	5	14	3,644	1,029	422	-	402	19	1,691	271	-	-	-	-	7,479
BUUG	13	4	19	36	4,028	18	670	20	103	2	1,001	12	-	-	2	-	5,856
DIPLAHAN	1	-	2	3	849	-	436	-	214	-	1,849	-	-	-	3	-	3,351
IMELDA	16	-	13	29	3,008	-	73	-	355	-	690	-	-	-	1	-	4,128
IPIL (Capital)	-	-	-	-	4,673	725	337	-	178	37	2,688	16	-	-	4	-	8,657
KABASALAN	-	-	1	1	3,742	31	352	-	381	15	839	-	-	-	-	-	5,360
MABUHAY	-	-	-	-	1,237	200	-	52	-	-	675	184	-	-	-	-	2,348
MALANGAS	20	3	9	32	5,542	292	110	-	489	-	1,510	129	-	-	3	-	8,074
NAGA	-	-	-	-	4,648	1,662	28	12	130	13	832	87	-	-	-	-	7,412
OLUTANGA	-	-	-	-	139	64	-	23	-	-	9	22	-	-	-	-	256
PAYAO	14	-	4	18	4,942	238	578	-	33	-	2,071	148	-	-	57	-	8,066
ROSELLER LIM	3	-	3	7	5,668	63	128	-	1,016	12	2,174	-	-	-	-	-	9,061
SIAY	7	-	4	11	3,265	-	590	-	1,016	-	2,594	-	-	-	-	-	7,464
TALUSAN	-	-	-	-	151	477	18	113	-	-	132	454	-	-	-	-	1,344
TITAY	2	1	2	5	6,574	5,183	106	21	170	126	1,480	668	-	-	-	-	14,328
TUNGAWAN	5	-	3	8	9,547	-	371	-	5,652	-	2,831	-	-	-	-	-	18,402
TOTAL	91	8	64	**163**	61,658	9,981	4,218	240	10,138	225	23,065	1,991	-	-	71	-	**111,586**

Note: Delivery of coffee planting materials must be started on the onset of rainy season.
**establishment of shade trees prior to planting of coffee.*

SUITABILITY CLASSES:

Highly Suitable (S1)
Land having no significant limitation to sustained application of a given use, or only minor limitations that will not significantly reduce productivity or benefits and will not raise inputs above an acceptable level.

Moderately Suitable (S2)
Land having limitation which in aggregate are moderately severe for sustained application of a given use; the limitation will reduce productivity or benefits and increase required inputs to the extent that the overall advantage to be gained from the use, although still attractive, will be appreciably inferior to that expected on class S1 land.

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Land having limitations which in aggregate are severe for sustained application of a given use and will so reduce productivity or benefits, or increase required inputs, that this expenditure will be only marginally justified.

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AGRONOMIC REQUIREMENT OF CACAO PRODUCTION

LAND UTILIZATION TYPE	SUITABILITY RATING	SLOPE (%)	SOIL DEPTH (cm)	SOIL TEXTURE	SOIL DRAINAGE	SOIL REACTION (pH)	INHERENT FERTILITY	FLOODING CLASS	EROSION CLASS	ROCK OUTCROPS	ELEVATION (masl)	ANNUAL RAINFALL (mm)	CLIMATIC TYPE
Cacao	S1	<8	>100	CL, SiCL, SCL, SC, SiC, C, HC	WD,MWD	5.6 -7.2	high	none-slight	none-slight	none-few	<1000	2001-4500	I, III, IV
	S2	8 - 30	50 - 100	FSL, L, SiL	SPD,PD	5.1 - 5.5 7,3 - 7,8	medium	moderate	moderate	common	1000-1500	1000-2000	I, II
	S3	>30	<50	S, LS, CSL, SL	VPD,ED	<5.0 - > 7.9	low	severe	severe	many	>1500	<1000 >4500	

SLOPE (%)
0 - 3 - level to gently sloping
3 - 8 - gently sloping to undulating
8 - 18 - undulating to rolling
18 - 30 - rolling to moderately steep
30 - 50 - steep
> 50 - very steep

SOIL DEPTH (cm)
0 - 30 - very shallow
30 - 50 - shallow
50 - 100 - moderately deep
> 100 - deep to very deep

SOIL DRAINAGE
ED - excessively drained
WD - well drained
MWD - moderately well drained
SPD - somewhat poorly drained
PD - poorly drained
VPD - very poorly drained

SURFACE IMPEDIMENT
ROCK OUTCROPS
< 10% - none - few
10 - 30% - common
> 30% - many

SOIL REACTION (pH)
< 4.5 - extremely acid
4.5 - 5.0 - very strongly acid
5.1 - 5.5 - strongly acid
5.6 - 6.0 - medium acid
6.1 - 6.5 - slightly acid
6.6 - 7.2 - neutral
7.3 - 7.8 - mildly alkaline
7.9 - 8.4 - moderately alkaline
> 8.5 - strongly alkaline

SOIL TEXTURE
Coarse
S - sand
LS - loamy sand
CSL - coarse sandy loam
SL - sandy loam
Medium
FSL - fine sandy loam
L - loam
SiL - silt loam
CL - clay loam
SiCL - silty clay loam
SCL - sandy clay loam
Fine
SC - sandy clay
SiC - silty clay
C - clay
HC - heavy clay

CLIMATE TYPE

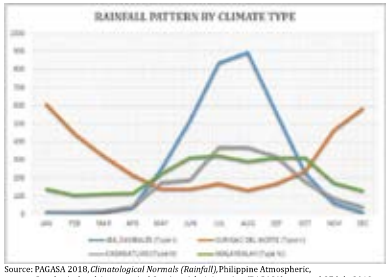
TYPE I : Two pronouced season, dry from November to April and wet during the rest of the year. Maximum rain period is from June to September

TYPE II : No dry season with a very pronounced maximum rain period from December to February. There is not a single dry month. Maximum monthly rainfall occurs during the period from March to May.

TYPE III : No very pronounced maximum rain period, with a dry season lasting only from one to three months, either during the period from December to February or from March to May. This type resembles Type I since it has a short dry season.

TYPE IV : Rainfall is more or less evenly distributed throughout the year. This type resembles Type II since it has no dry season.

Western part of Zamboaga Sibugay is classified as climatic Type III and Eastern part is Type IV.



Source: PAGASA 2018, *Climatological Normals (Rainfall)*, Philippine Atmospheric, Geophysical and Astronomical Services Administration (PAGASA), accessed 27 July 2018, <https://www1.pagasa.dost.gov.ph/index.php/climate/climatological-normals>.

LAND LIMITATIONS DESCRIPTION AND COMBINATIONS

ELEVATION
EI2 - 1000m - 1500m
EI3 - > 1500m

SLOPE/TOPOGRAPHY
T2 - Undulating to moderately steep
T3 - Steep to very steep

SOIL DRAINAGE
D2 - Somewhat poorly drained to poorly drained
D3 - Very poorly drained or excessively drained

SOIL TEXTURE
Tc - Coarse texture

SOIL DEPTH
Sh2 - Moderately deep (50 - 100cm)
Sh3 - Very shallow to shallow (< 50cm)

ROCK OUTCROPS
Rc2 - Common
Rc3 - Many

SOIL EROSION
E2 - Moderate erosion
E3 - Severe erosion

FLOODING
F2 - Moderate seasonal flooding
F3 - Severe seasonal flooding

CODE	LIMITATION	CODE	LIMITATION	CODE	LIMITATION	CODE	LIMITATION
1	E2-Sh2-Rc2	11	T2-E3-Rc3	21	T3-E3-Rc2	31	T3-E3-Rc3
2	EI2	12	T2-E3-Sh2-Rc2	22	T3-E3-Sh2-Rc3	32	T3-E3-Sh3-Rc3
3	EI2-Sh2-Rc2	13	T2-E3-Sh2-Rc3	23	T3-E3-Sh3-Rc2	33	T3-EI2-E3
4	EI2-Sh2-Rc3	14	T2-EI2	24	T3-E3-Sh3-Rc3	34	T3-EI2-E3-Sh3-Rc3
5	F2-D2	15	T2-EI2-E3	25	T3-EI2	35	T3-EI3
6	F3-D2	16	T2-EI2-E3-Sh2-Rc2	26	T3-EI2-E3		
7	Sh2-Rc2	17	T2-EI2-E3-Sh2-Rc3	27	T3-EI2-E3-Sh3-Rc2		
8	T2	18	T2-F2-D2	28	T3-EI2-E3-Sh3-Rc3		
9	T2-E3	19	T3	29	T3		
10	T2-E3-Rc2	20	T3-E3	30	T3-E3		

CODE	LANDUSE	CODE	LANDUSE
4	Corn	137	Rubber
81	Coffee	139	Falcata
82	Cacao		
85	Mango		
91	Banana		
105	Fruit trees, mixed		
115	Mixed crops		
116	Coconut		
126	Grassland		
134	Shrubs, unmanaged		

LAND SUITABILITY MAP FOR CACAO

LAND RESOURCES EVALUATION AND SUITABILITY ASSESSMENT OF STRATEGIC PRODUCTION AREAS

BUKIDNON, REGION X

EXTENT OF SUITABILITY FOR CACAO PRODUCTION BY MUNICIPALITY

MUNICIPALITY	EXISTING CACAO (Ha)			TOTAL EXISTING AREA (Ha)	EXPANSION AREA (Ha)						CONFLICT RESOLUTION AREA (Ha)										TOTAL POTENTIAL EXPANSION AREA (Ha)
					Coconut		Shrubland, unmanaged*		Grassland, unmanaged*		Corn		Sugarcane		Banana		Vegetables		Other crops		
	S1	S2	S3		S1	S2	S1	S2	S1	S2	S1	S2	S1	S2	S1	S2	S1	S2	S1	S2	
BAUNGON	49	16	18	83	1,392	30	-	1	1,992	2,047	4,740	2,591	-	-	41	10	-	-	88	34	12,966
CABANGLASAN	5	-	-	5	-	-	217	198	9	290	2,280	4,453	1	-	-	-	-	-	99	40	7,586
CITY OF MALAYBALAY	-	-	-	-	79	96	83	84	1,135	2,985	1,895	8,139	-	-	1,871	14,286	-	-	-	-	30,653
CITY OF VALENCIA	-	-	-	-	9	-	331	1,416	376	778	2,371	6,134	2,201	183	1,988	2,922	-	-	72	-	18,781
DAMULOG	12	-	6	18	798	4	4	-	84	-	202	28	-	-	-	-	7,675	158	-	-	8,954
DANGCAGAN	-	-	-	-	163	253	-	-	-	-	4,441	165	4	-	-	-	-	26	-	-	5,052
DON CARLOS	6	-	-	6	95	-	199	6	61	41	2,216	84	10,201	805	-	-	27	-	510	-	14,245
IMPASUG-ONG	-	-	58	58	-	572	3	366	134	1,142	19	5,032	-	-	-	581	-	-	-	1,779	9,629
KADINGILAN	13	1	2	17	58	1	9	3	3,268	279	5,614	137	72	61	-	-	1	-	-	-	9,503
KALILANGAN	-	8	7	15	-	53	3	212	-	1	2,908	9,632	386	811	-	1	-	-	-	-	14,008
KIBAWE	-	-	-	-	1,207	237	42	5	46	-	3,596	734	1,415	511	43	-	1,829	31	1	2	9,699
KITAOTAO	9	1	14	24	433	4	-	167	121	1,174	2,580	256	6,694	267	-	-	58	4	-	-	11,758
LANTAPAN	-	-	-	-	-	-	-	376	-	146	1,615	12,264	263	45	272	73	-	-	-	-	15,054
LIBONA	-	1	3	4	500	229	101	588	32	1,532	312	450	-	-	95	10,576	-	-	-	-	14,417
MALITBOG	-	-	1	1	633	985	344	864	386	997	498	1,408	-	-	-	738	-	-	-	-	6,854
MANOLO FORTICH	-	1	5	6	491	477	339	736	299	1,733	5,247	8,345	-	-	-	342	-	-	466	424	18,900
MARAMAG	6	9	5	21	524	13	169	430	605	382	2,964	380	5,035	5,194	1	358	108	-	235	233	16,630
PANGANTUCAN	9	4	54	67	3	131	74	42	-	79	2,740	7,301	1,768	4,488	-	1,177	-	-	-	2	17,805
QUEZON	2	-	6	7	11	7	71	-	1,061	2,495	83	240	13,646	285	-	-	957	5	-	-	18,861
SAN FERNANDO	30	15	41	86	-	3	111	216	1,832	2,028	1,579	2,166	-	-	40	32	-	-	-	-	8,007
SUMILAO	-	-	-	-	-	-	110	423	12	2,129	245	817	-	-	-	42	-	-	113	5,132	9,023
TALAKAG	-	58	10	68	3,674	7,858	39	9,980	329	6,503	243	5,430	-	-	-	14	-	-	-	4,522	38,591
TOTAL	140	114	230	**484**	10,069	10,955	2,249	16,113	11,782	26,761	48,390	76,186	41,685	12,650	4,351	31,152	10,656	225	1,584	12,167	**316,976**

Note: Delivery of cacao planting materials must be started on the onset of rainy season.
**establishment of shade trees prior to planting of cacao.*

AGRONOMIC REQUIREMENT OF CACAO PRODUCTION

LAND UTILIZATION TYPE	SUITABILITY RATING	SLOPE (%)	SOIL DEPTH (cm)	SOIL TEXTURE	SOIL DRAINAGE	SOIL REACTION (pH)	INHERENT FERTILITY	FLOODING CLASS	EROSION CLASS	ROCK OUTCROPS	ELEVATION (masl)	ANNUAL RAINFALL (mm)	CLIMATIC TYPE
Cacao	S1	<8	>100	CL, SiCL, SCL, SC, SiC, C, HC	WD,MWD	5.6 - 7.2	high	none-slight	none-slight	none-few	<1000	2001-4500	I, III, IV
	S2	8 - 30	50 - 100	FSL, L, SiL	SPD,PD	5.1 - 5.5 7.3 - 7.8	medium	moderate	moderate	common	1000-1500	1000-2000	I, II
	S3	>30	<50	S, LS, CSL, SL	VPD,ED	<5.0 - > 7.9	low	severe	severe	many	>1500	<1000 >4500	

SLOPE (%)
0 - 3 - level to gently sloping
3 - 8 - gently sloping to undulating
8 - 18 - undulating to rolling
18 - 30 - rolling to moderately steep
30 - 50 - steep
> 50 - very steep

SOIL DEPTH (cm)
0 - 30 - very shallow
30 - 50 - shallow
50 - 100 - moderately deep
> 100 - deep to very deep

SOIL DRAINAGE
ED - excessively drained
WD - well drained
MWD - moderately well drained
SPD - somewhat poorly drained
PD - poorly drained
VPD - very poorly drained

SURFACE IMPEDIMENT
ROCK OUTCROPS
< 10% - none - few
10 - 30% - common
> 30% - many

SOIL REACTION (pH)
< 4.5 - extremely acid
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7.9 - 8.4 - moderately alkaline
> 8.5 - strongly alkaline

SOIL TEXTURE
Coarse
S - sand
LS - loamy sand
CSL - coarse sandy loam
SL - sandy loam
Medium
FSL - fine sandy loam
L - loam
SiL - silt loam
CL - clay loam
SiCL - silty clay loam
SCL - sandy clay loam
Fine
SC - sandy clay
SiC - silty clay
C - clay
HC - heavy clay

LAND LIMITATIONS DESCRIPTION AND COMBINATIONS

ELEVATION
El2 - 1000m - 1500m
El3 - > 1500m

SLOPE/TOPOGRAPHY
T2 - Undulating to moderately steep
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SOIL DRAINAGE
D2 - Somewhat poorly drained to poorly drained
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SOIL TEXTURE
Tc - Coarse texture

SOIL DEPTH
Sh2 - Moderately deep (50 - 100cm)
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ROCK OUTCROPS
Rc2 - Common
Rc3 - Many

SOIL EROSION
E2 - Moderate erosion
E3 - Severe erosion

FLOODING
F2 - Moderate seasonal flooding
F3 - Severe seasonal flooding

CODE	LIMITATION	CODE	LIMITATION	CODE	LIMITATION	CODE	LIMITATION	CODE	LIMITATION	CODE	LIMITATION
1	E2-Sh2-Rc2	11	El3-E3-Sh2-Rc3	21	T2-El2-E3	31	T3-E3	41	T3-El3-E3	51	T3-El2-E3-Sh3-Rc3
2	El2	12	El3-Rc2	22	T2-El2-E3-Rc2	32	T3-E3-Sh2-Rc3	42	T3-El3-E3-Rc2	52	T3-El3-E3
3	El2-E3-Rc3	13	El3-Sh2-Rc2	23	T2-El2-E3-Rc3	33	T3-E3-Sh3-Rc2	43	T3-El3-E3-Sh3-Rc2	53	T3-El3-E3-Rc3
4	El2-E3-Sh2-Rc3	14	Sh2-Rc2	24	T2-El2-E3-Sh2-Rc2	34	T3-E3-Sh3-Rc3	44	T3-El3-E3-Sh3-Rc2	54	T3-El3-E3-Sh3-Rc3
5	El2-F2-D2	15	T2	25	T2-El2-E3-Sh2-Rc3	35	T3-El2	45	T3		
6	El2-Rc2	16	T2-E3	26	T2-El3-E3	36	T3-El2-E3	46	T3-El3		
7	El2-Sh2-Rc2	17	T2-E3-Rc3	27	T2-El3-E3-Rc2	37	T3-El2-E3-Rc2	47	T3-E3-Sh3-Rc3		
8	El2-Sh2-Rc3	18	T2-E3-Sh2-Rc2	28	T2-El3-E3-Sh2-Rc2	38	T3-El2-E3-Sh2-Rc3	48	T3-El2		
9	El3	19	T2-E3-Sh2-Rc3	29	T2-El3-E3-Sh2-Rc3	39	T3-El2-E3-Sh3-Rc2	49	T3-El2-E3		
10	El3-E2-Sh2-Rc3	20	T2-El2	30	T3	40	T3-El2-E3-Sh3-Rc3	50	T3-El2-E3-Rc3		

CODE	LANDUSE	CODE	LANDUSE
4	Corn	119	Oil palm
81	Coffee	126	Grassland
82	Cacao	134	Shrubs, unmanaged
84	Pineapple	137	Rubber
85	Mango		
91	Banana		
105	Fruit trees, mixed		
112	Sugarcane		
115	Mixed crops		
116	Coconut		

SUITABILITY CLASSES:

Highly Suitable (S1)
Land having no significant limitation to sustained application of a given use, or only minor limitations that will not significantly reduce productivity or benefits and will not raise inputs above an acceptable level.

Moderately Suitable (S2)
Land having limitation which in aggregate are moderately severe for sustained application of a given use; the limitation will reduce productivity or benefits and increase required inputs to the extent that the overall advantage to be gained from the use, although still attractive, will be appreciably inferior to that expected on class S1 land.

Marginally Suitable (S3)
Land having limitations which in aggregate are severe for sustained application of a given use and will so reduce productivity or benefits, or increase required inputs, that this expenditure will be only marginally justified.

Not Suitable / Not Relevant
Land having limitations which may be surmountable in time but which cannot be corrected with existing knowledge at currently acceptable cost; the limitations are so severe as to preclude successful sustained use of the land in the given manner. Existing forest, shrubland greater than 18% slope, irrigated paddy rice and miscellaneous land types such as built up areas, roads, etc are considered as not relevant.

CLIMATE TYPE

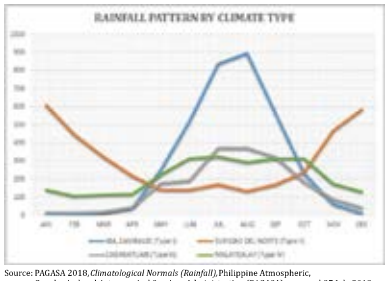
TYPE I : Two pronouced season, dry from November to April and wet during the rest of the year. Maximum rain period is from June to September

TYPE II : No dry season with a very pronounced maximum rain period from December to February. There is not a single dry month, Maximum monthly rainfall occurs during the period from March to May.

TYPE III : No very pronounced maximum rain period, with a dry season lasting only from one to three months, either during the period from December to February or from March to May, This type resembles Type I since it has a short dry season.

TYPE IV : Rainfall is more or less evenly distributed throughout the year, This type resembles Type II since it has no dry season.

Western part of Bukidnon is classified as climatic Type III and Northeastern part is Type IV.



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LAND SUITABILITY MAP FOR CACAO

LAND RESOURCES EVALUATION AND SUITABILITY ASSESSMENT OF STRATEGIC PRODUCTION AREAS

CAMIGUIN, REGION X

EXTENT OF SUITABILITY FOR CACAO PRODUCTION BY MUNICIPALITY

MUNICIPALITY	EXISTING CACAO (Ha)			TOTAL EXISTING AREA (Ha)	EXPANSION AREA (Ha)						CONFLICT RESOLUTION AREA (Ha)						TOTAL POTENTIAL EXPANSION AREA (Ha)
					Coconut		Shrubland, unmanaged*		Grassland, unmanaged*		Corn		Paddy rice, non-irrigated		Other crops		
	S1	S2	S3		S1	S2	S1	S2	S1	S2	S1	S2	S1	S2	S1	S2	
CATARMAN	-	1	-	1	1,979	450	-	-	15	-	-	-	-	-	-	-	2,444
GUINSILIBAN	-	-	-	-	587	-	-	-	34	-	-	-	-	-	-	-	621
MAHINOG	-	-	1	1	812	-	-	-	25	-	25	-	-	-	-	-	862
MAMBAJAO	-	-	1	1	2,516	495	-	-	49	-	72	41	-	-	-	-	3,172
SAGAY	-	-	1	1	502	423	-	-	58	-	29	3	-	-	-	-	1,015
TOTAL	-	1	3	4	6,396	1,369	-	-	181	-	125	44	-	-	-	-	8,115

Note: Delivery of cacao planting materials must be started on the onset of rainy season.
**establishment of shade trees prior to planting of cacao.*

SUITABILITY CLASSES:

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AGRONOMIC REQUIREMENT OF CACAO PRODUCTION

LAND UTILIZATION TYPE	SUITABILITY RATING	SLOPE (%)	SOIL DEPTH (cm)	SOIL TEXTURE	SOIL DRAINAGE	SOIL REACTION (pH)	INHERENT FERTILITY	FLOODING CLASS	EROSION CLASS	ROCK OUTCROPS	ELEVATION (masl)	ANNUAL RAINFALL (mm)	CLIMATIC TYPE
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	S2	8 - 30	50 - 100	FSL, L, SiL	SPD,PD	5.1 - 5.5 7.3 - 7.8	medium	moderate	moderate	common	1000-1500	1000-2000	I, II
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ROCK OUTCROPS
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Coarse
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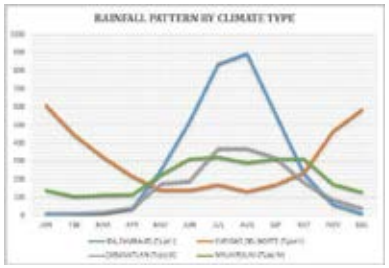
TYPE IV : Rainfall is more or less evenly distributed throughout the year. This type resembles Type II since it has no dry season.

Whole part of Camiguin is classified as climatic Type IV.



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LAND LIMITATIONS DESCRIPTION AND COMBINATIONS

ELEVATION
El2 - 1000m - 1500m
El3 - > 1500m

SLOPE/TOPOGRAPHY
T2 - Undulating to moderately steep
T3 - Steep to very steep

SOIL DRAINAGE
D2 - Somewhat poorly drained to poorly drained
D3 - Very poorly drained or excessively drained

SOIL TEXTURE
Tc - Coarse texture

SOIL DEPTH
Sh2 - Moderately deep (50 - 100cm)
Sh3 - Very shallow to shallow (< 50cm)

ROCK OUTCROPS
Rc2 - Common
Rc3 - Many

SOIL EROSION
E2 - Moderate erosion
E3 - Severe erosion

FLOODING
F2 - Moderate seasonal flooding
F3 - Severe seasonal flooding

CODE	LIMITATION	CODE	LIMITATION	CODE	LIMITATION
1	E2-Sh2-Rc2	11	T3-E3-Sh3-Rc2	21	Tc
2	El2-Sh2-Rc2	12	T3-E3-Sh3-Rc3		
3	F2-Tc	13	T3-El2		
4	Sh2-Rc2	14	T3-El2-E3-Sh3-Rc2		
5	T2	15	T3-El3-E3-Sh3-Rc2		
6	T2-E3-Sh2-Rc2	16	T3		
7	T2-E3-Sh2-Rc3	17	T3-E3-Sh3-Rc3		
8	T2-El2	18	T3-El2		
9	T2-El2-E3-Sh2-Rc2	19	T3-El2-E3-Sh3-Rc3		
10	T3	20	T3-El3-E3-Sh3-Rc3		

CODE	LANDUSE
1	Paddy rice, irrigated
2	Paddy rice, non-irrigated
4	Corn
82	Cacao
116	Coconut
126	Grassland
130	Bare areas, unmanaged
134	Shrubs, unmanaged

LAND SUITABILITY MAP FOR CACAO

LAND RESOURCES EVALUATION AND SUITABILITY ASSESSMENT OF STRATEGIC PRODUCTION AREAS

LANAO DEL NORTE, REGION X

EXTENT OF SUITABILITY FOR CACAO PRODUCTION BY MUNICIPALITY

MUNICIPALITY	EXISTING CACAO (Ha)			TOTAL EXISTING AREA (Ha)	EXPANSION AREA (Ha)						CONFLICT RESOLUTION (Ha)						TOTAL POTENTIAL EXPANSION AREA (Ha)
					Coconut		Shrubland, unmanaged*		Grassland, unmanaged*		Corn		Rice paddy, non-irrigated		Other crops		
	S1	S2	S3		S1	S2	S1	S2	S1	S2	S1	S2	S1	S2	S1	S2	
BACOLOD	-	-	-	-	9,739	-	-	-	-	-	191	-	466	-	-	-	10,396
BALOI	-	-	-	-	1,425	-	211	-	-	-	8,298	117	1,863	-	-	-	11,914
BARIO	-	-	-	-	6,664	-	-	-	-	-	704	-	377	-	-	-	7,744
ILIGAN CITY	159	4	313	476	7,812	1,288	2,502	1,074	2,328	1,229	430	365	70	20	-	-	17,119
KAPATAGAN	-	-	-	-	7,111	252	30	-	9	-	3,268	-	1,348	5	-	-	12,023
KAUSWAGAN	-	-	-	-	10,062	483	60	54	-	-	285	75	252	3	-	-	11,275
KOLAMBUGAN	-	-	-	-	4,941	-	-	-	-	-	65	-	771	-	-	-	5,777
LALA	-	-	-	-	2,346	-	-	-	-	-	4,282	-	2,385	-	-	-	9,013
LINAMON	-	-	-	-	2,701	-	7	-	-	-	153	-	19	-	-	-	2,879
MAGSAYSAY	-	-	-	-	6,881	217	-	-	-	-	-	-	-	-	-	-	7,098
MAIGO	3	-	7	10	8,885	3	46	-	-	-	39	-	2,045	-	-	-	11,018
MATUNGAO	-	-	1	1	689	8	47	36	-	-	2,651	333	159	-	-	-	3,922
MUNAI	-	-	-	-	956	3,704	2	1,594	-	-	363	1,411	87	205	-	-	8,323
NUNUNGAN	-	-	-	-	3,388	1,871	145	184	55	522	288	168	-	2	-	-	6,621
PANTAO RAGAT	-	7	-	7	-	936	54	1,016	-	-	265	3,011	11	115	-	-	5,409
PANTAR	-	11	20	31	-	-	321	684	-	10	618	1,701	56	29	-	-	3,418
POONA PIAGAPO	-	18	25	43	2,448	592	131	537	-	-	1,647	2,284	47	12	-	-	7,698
SALVADOR	-	-	-	-	8,521	-	-	-	130	-	3,552	-	600	-	-	-	12,803
SAPAD	-	-	-	-	6,416	120	2	-	-	-	4,557	-	823	-	-	-	11,917
SULTAN NAGA DIMAPORO	-	-	-	-	6,921	2,697	-	19	-	72	1,839	980	1,722	221	-	-	14,470
TAGOLOAN	1	1	22	24	1,575	105	467	770	317	44	769	2,892	86	227	-	-	7,253
TANGCAL	-	-	-	-	2,531	239	-	7	-	-	-	-	7	-	-	-	2,784
TUBOD	-	-	-	-	18,523	247	-	-	-	-	345	-	197	-	-	-	19,312
TOTAL	163	41	388	592	120,534	12,761	4,026	5,975	2,839	1,876	34,607	13,339	13,389	840	-	-	210,185

Note: Delivery of cacao planting materials must be started on the onset of rainy season.
**establishment of shade trees prior to planting of cacao.*

AGRONOMIC REQUIREMENT OF CACAO PRODUCTION

LAND UTILIZATION TYPE	SUITABILITY RATING	SLOPE (%)	SOIL DEPTH (cm)	SOIL TEXTURE	SOIL DRAINAGE	SOIL REACTION (pH)	INHERENT FERTILITY	FLOODING CLASS	EROSION CLASS	ROCK OUTCROPS	ELEVATION (masl)	ANNUAL RAINFALL (mm)	CLIMATIC TYPE
Cacao	S1	<8	>100	CL, SiCL, SCL, SC, SiC, C, HC	WD,MWD	5.6 -7.2	high	none-slight	none-slight	none-few	<1000	2001-4500	I, III, IV
	S2	8 - 30	50 - 100	FSL, L, SiL	SPD,PD	5.1 - 5.5 7.3 - 7.8	medium	moderate	moderate	common	1000-1500	1000-2000	I, II
	S3	>30	<50	S, LS, CSL, SL	VPD,ED	<5.0 - > 7.9	low	severe	severe	many	>1500	<1000 >4500	

SLOPE (%)
0 - 3 - level to gently sloping
3 - 8 - gently sloping to undulating
8 - 18 - undulating to rolling
18 - 30 - rolling to moderately steep
30 - 50 - steep
> 50 - very steep

SOIL DEPTH (cm)
0 - 30 - very shallow
30 - 50 - shallow
50 - 100 - moderately deep
> 100 - deep to very deep

SOIL DRAINAGE
ED - excessively drained
WD - well drained
MWD - moderately well drained
SPD - somewhat poorly drained
PD - poorly drained
VPD - very poorly drained

SURFACE IMPEDIMENT
ROCK OUTCROPS
< 10% - none - few
10 - 30% - common
> 30% - many

SOIL REACTION (pH)
< 4.5 - extremely acid
4.5 - 5.0 - very strongly acid
5.1 - 5.5 - strongly acid
5.6 - 6.0 - medium acid
6.1 - 6.5 - slightly acid
6.6 - 7.2 - neutral
7.3 - 7.8 - mildly alkaline
7.9 - 8.4 - moderately alkaline
> 8.5 - strongly alkaline

SOIL TEXTURE
Coarse
S - sand
LS - loamy sand
CSL - coarse sandy loam
SL - sandy loam
Medium
FSL - fine sandy loam
L - loam
SiL - silt loam
CL - clay loam
SiCL - silty clay loam
SCL - sandy clay loam
Fine
SC - sandy clay
SiC - silty clay
C - clay
HC - heavy clay

LAND LIMITATIONS DESCRIPTION AND COMBINATIONS

ELEVATION
E2 - 1000m - 1500m
E3 - > 1500m

SOIL DRAINAGE
D2 - Somewhat poorly drained to poorly drained
D3 - Very poorly drained or excessively drained

SOIL DEPTH
Sh2 - Moderately deep (50 - 100cm)
Sh3 - Very shallow to shallow (< 50cm)

SOIL EROSION
E2 - Moderate erosion
E3 - Severe erosion

SLOPE/TOPOGRAPHY
T2 - Undulating to moderately steep
T3 - Steep to very steep

SOIL TEXTURE
Tc - Coarse texture

ROCK OUTCROPS
Rc2 - Common
Rc3 - Many

FLOODING
F2 - Moderate seasonal flooding
F3 - Severe seasonal flooding

CODE	LIMITATION	CODE	LIMITATION	CODE	LIMITATION	CODE	LIMITATION	CODE	LIMITATION
1	E2-Sh2-Rc2	11	T2	21	T2-EI2-E3-Sh2-Rc3	31	T3-EI2-E3-Rc2	41	T3-EI2-E3
2	EI2	12	T2-E3	22	T2-EI3-E3-Sh2-Rc2	32	T3-EI2-E3-Sh2-Rc3	42	T3-EI2-E3-Sh3-Rc3
3	EI2-E3-Rc3	13	T2-E3-Rc3	23	T2-F2-D2	33	T3-EI2-E3-Sh3-Rc2	43	T3-EI3
4	EI2-Rc2	14	T2-E3-Sh2-Rc2	24	T2-F3-D2	34	T3-EI2-E3-Sh3-Rc3		
5	EI2-Sh2-Rc2	15	T2-E3-Sh2-Rc3	25	T3	35	T3-EI3-E3-Sh3-Rc2		
6	EI2-Sh2-Rc3	16	T2-EI2	26	T3-E3	36	T3-F2-D2		
7	F2-D2	17	T2-EI2-E3	27	T3-E3-Sh2-Rc3	37	T3		
8	F2-Tc	18	T2-EI2-E3-Rc2	28	T3-E3-Sh3-Rc2	38	T3-E3		
9	F3-D2	19	T2-EI2-E3-Rc3	29	T3-EI2	39	T3-E3-Sh3-Rc3		
10	Sh2-Rc2	20	T2-EI2-E3-Sh2-Rc2	30	T3-EI2-E3	40	T3-EI2		

CODE	LANDUSE
4	Corn
81	Coffee
82	Cacao
116	Cocomut
126	Grassland
134	Srubs, unmanaged

SUITABILITY CLASSES:

Highly Suitable (S1)
Land having no significant limitation to sustained application of a given use, or only minor limitations that will not significantly reduce productivity or benefits and will not raise inputs above an acceptable level.

Moderately Suitable (S2)
Land having limitation which in aggregate are moderately severe for sustained application of a given use; the limitation will reduce productivity or benefits and increase required inputs to the extent that the overall advantage to be gained from the use, although still attractive, will be appreciably inferior to that expected on class S1 land.

Marginally Suitable (S3)
Land having limitations which in aggregate are severe for sustained application of a given use and will so reduce productivity or benefits, or increase required inputs, that this expenditure will be only marginally justified.

Not Suitable / Not Relevant
Land having limitations which may be surmountable in time but which cannot be corrected with existing knowledge at currently acceptable cost; the limitations are so severe as to preclude successful sustained use of the land in the given manner. Existing forest, shrubland greater than 18% slope, irrigated paddy rice and miscellaneous land types such as built up areas, roads, etc are considered as not relevant.

CLIMATE TYPE

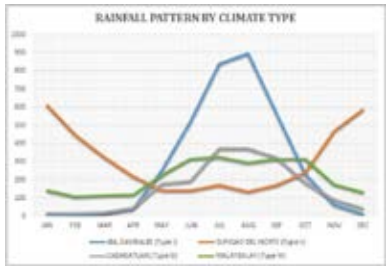
TYPE I : Two pronouced season, dry from November to April and wet during the rest of the year. Maximum rain period is from June to September

TYPE II : No dry season with a very pronounced maximum rain period from December to February. There is not a single dry month. Maximum monthly rainfall occurs during the period from March to May.

TYPE III : No very pronounced maximum rain period, with a dry season lasting only from one to three months, either during the period from December to February or from March to May. This type resembles Type I since it has a short dry season.

TYPE IV : Rainfall is more or less evenly distributed throughout the year. This type resembles Type II since it has no dry season.

Whole part of Lanao Del Norte is classified as climatic Type III.



Source: PAGASA 2018, *Climatological Normals (Rainfall)*, Philippine Atmospheric, Geophysical and Astronomical Services Administration (PAGASA), accessed 27 July 2018, <https://www1.pagasa.dost.gov.ph/index.php/climate/climatological-normals>.

LAND SUITABILITY MAP FOR CACAO

LAND RESOURCES EVALUATION AND SUITABILITY ASSESSMENT OF STRATEGIC PRODUCTION AREAS

MISAMIS OCCIDENTAL, REGION X

EXTENT OF SUITABILITY FOR CACAO PRODUCTION BY MUNICIPALITY

MUNICIPALITY	EXISTING CACAO (Ha)			TOTAL EXISTING AREA (Ha)	EXPANSION AREA (Ha)						CONFLICT RESOLUTION (Ha)						TOTAL POTENTIAL EXPANSION AREA (Ha)
					Coconut		Shrubland, unmanaged*		Grassland, unmanaged*		Corn		Paddy rice, non-irrigated		Other crops		
	S1	S2	S3		S1	S2	S1	S2	S1	S2	S1	S2	S1	S2	S1	S2	
ALORAN	-	-	-	-	3,656	277	41	24	-	-	92	-	-	-	-	-	4,090
BALIANGAO	2	-	-	2	3,922	-	-	-	-	-	544	-	-	-	-	-	4,467
BONIFACIO	-	-	-	-	3,417	384	49	-	10	-	2,282	-	-	-	-	-	6,143
CALAMBA	5	-	-	5	4,236	106	-	-	489	4	164	-	-	-	-	-	5,000
CLARIN	-	-	-	-	2,942	17	-	3	43	24	252	22	-	-	-	-	3,302
CONCEPCION	-	-	-	-	101	536	-	-	94	246	6	786	-	-	-	-	1,770
DON VICTORIANO CHIONGBIAN	-	-	-	-	47	513	-	146	-	87	-	567	-	-	-	-	1,361
JIMENEZ	-	-	-	-	2,496	289	9	-	101	-	96	-	-	-	-	-	2,993
LOPEZ JAENA	-	-	-	-	6,899	132	49	-	35	-	275	5	-	-	-	-	7,395
OROQUIETA CITY	3	-	-	3	7,664	420	-	-	-	-	117	-	-	-	-	-	8,201
OZAMIS CITY	-	-	-	-	9,035	56	-	1	33	18	1,727	198	-	-	-	-	11,067
PANAON	-	-	-	-	2,317	138	-	-	-	-	88	-	-	-	-	-	2,544
PLARIDEL	1	-	-	1	4,919	58	-	-	-	-	1,038	8	-	-	-	-	6,024
SAPANG DALAGA	2	-	1	3	7,190	442	3	-	157	-	64	39	-	-	-	-	7,895
SINACABAN	2	-	-	2	3,475	532	-	-	45	89	32	-	-	-	-	-	4,174
TANGUB CITY	1	-	-	1	6,165	297	54	2	43	57	3,169	101	-	-	-	-	9,888
TUDELA	-	-	-	-	4,148	713	-	-	2	24	43	-	-	-	-	-	4,930
TOTAL	16	-	1	17	72,631	4,911	204	176	1,053	548	9,991	1,727	-	-	-	-	91,242

Note: Delivery of cacao planting materials must be started on the onset of rainy season.
**establishment of shade trees prior to planting of cacao.*

AGRONOMIC REQUIREMENT OF CACAO PRODUCTION

LAND UTILIZATION TYPE	SUITABILITY RATING	SLOPE (%)	SOIL DEPTH (cm)	SOIL TEXTURE	SOIL DRAINAGE	SOIL REACTION (pH)	INHERENT FERTILITY	FLOODING CLASS	EROSION CLASS	ROCK OUTCROPS	ELEVATION (masl)	ANNUAL RAINFALL (mm)	CLIMATIC TYPE
Cacao	S1	<8	>100	CL, SiCL, SCL, SC, SiC, C, HC	WD,MWD	5.6 -7.2	high	none-slight	none-slight	none-few	<1000	2001-4500	I, III, IV
	S2	8 - 30	50 - 100	FSL, L, SiL	SPD,PD	5.1 - 5.5 7.3 - 7.8	medium	moderate	moderate	common	1000-1500	1000-2000	I, II
	S3	>30	<50	S, LS, CSL, SL	VPD,ED	<5.0 - > 7.9	low	severe	severe	many	>1500	<1000 >4500	

SLOPE (%)
0 - 3 - level to gently sloping
3 - 8 - gently sloping to undulating
8 - 18 - undulating to rolling
18 - 30 - rolling to moderately steep
30 - 50 - steep
> 50 - very steep

SOIL DEPTH (cm)
0 - 30 - very shallow
30 - 50 - shallow
50 - 100 - moderately deep
> 100 - deep to very deep

SOIL DRAINAGE
ED - excessively drained
WD - well drained
MWD - moderately well drained
SPD - somewhat poorly drained
PD - poorly drained
VPD - very poorly drained

SURFACE IMPEDIMENT
ROCK OUTCROPS
< 10% - none - few
10 - 30% - common
> 30% - many

SOIL REACTION (pH)
< 4.5 - extremely acid
4.5 - 5.0 - very strongly acid
5.1 - 5.5 - strongly acid
5.6 - 6.0 - medium acid
6.1 - 6.5 - slightly acid
6.6 - 7.2 - neutral
7.3 - 7.8 - mildly alkaline
7.9 - 8.4 - moderately alkaline
> 8.5 - strongly alkaline

SOIL TEXTURE
Coarse
S - sand
LS - loamy sand
CSL - coarse sandy loam
SL - sandy loam
Medium
FSL - fine sandy loam
L - loam
SiL - silt loam
CL - clay loam
SiCL - silty clay loam
SCL - sandy clay loam
Fine
SC - sandy clay
SiC - silty clay
C - clay
HC - heavy clay

LAND LIMITATIONS DESCRIPTION AND COMBINATIONS

ELEVATION
EI2 - 1000m - 1500m
EI3 - > 1500m

SLOPE/TOPOGRAPHY
T2 - Undulating to moderately steep
T3 - Steep to very steep

SOIL DRAINAGE
D2 - Somewhat poorly drained to poorly drained
D3 - Very poorly drained or excessively drained

SOIL TEXTURE
Tc - Coarse texture

SOIL DEPTH
Sh2 - Moderately deep (50 - 100cm)
Sh3 - Very shallow to shallow (< 50cm)

ROCK OUTCROPS
Rc2 - Common
Rc3 - Many

SOIL EROSION
E2 - Moderate erosion
E3 - Severe erosion

FLOODING
F2 - Moderate seasonal flooding
F3 - Severe seasonal flooding

CODE	LIMITATION	CODE	LIMITATION	CODE	LIMITATION	CODE	LIMITATION
1	E2-Sh2-Rc2	11	T2-E3	21	T2-F3-D2	31	T3
2	EI2	12	T2-E3-Rc2	22	T3	32	T3-E3
3	EI2-Sh2-Rc2	13	T2-E3-Sh2-Rc2	23	T3-E3	33	T3-E3-Sh3-Rc3
4	EI3	14	T2-E3-Sh2-Rc3	24	T3-E3-Sh3-Rc2	34	T3-EI2
5	EI3-Sh2-Rc2	15	T2-EI2	25	T3-EI2	35	T3-EI2-E3
6	F2-D2	16	T2-EI2-E3	26	T3-EI2-E3	36	T3-EI2-E3-Sh3-Rc3
7	F3-D2	17	T2-EI2-E3-Sh2-Rc2	27	T3-EI2-E3-Sh3-Rc2	37	T3-EI3
8	Sh2	18	T2-EI3	28	T3-EI3	38	T3-EI3-E3-Sh3-Rc3
9	Sh2-Rc2	19	T2-EI3-E3-Sh2-Rc2	29	T3-EI3-E3-Sh3-Rc2	39	T3-EI3
10	T2	20	T2-F2-D2	30	T3-F3-D2	40	T3-EI3-F3-D2

CODE	LANDUSE
4	Corn
81	Coffee
82	Cacao
116	Coconut
126	Grassland
134	Shrubs, unmanaged
137	Rubber

SUITABILITY CLASSES:

Highly Suitable (S1)
Land having no significant limitation to sustained application of a given use, or only minor limitations that will not significantly reduce productivity or benefits and will not raise inputs above an acceptable level.

Moderately Suitable (S2)
Land having limitation which in aggregate are moderately severe for sustained application of a given use; the limitation will reduce productivity or benefits and increase required inputs to the extent that the overall advantage to be gained from the use, although still attractive, will be appreciably inferior to that expected on class S1 land.

Marginally Suitable (S3)
Land having limitations which in aggregate are severe for sustained application of a given use and will so reduce productivity or benefits, or increase required inputs, that this expenditure will be only marginally justified.

Not Suitable / Not Relevant
Land having limitations which may be surmountable in time but which cannot be corrected with existing knowledge at currently acceptable cost; the limitations are so severe as to preclude successful sustained use of the land in the given manner, Existing forest, shrubland greater than 18% slope, irrigated paddy rice and miscellaneous land types such as built up areas, roads, etc are considered as not relevant.

CLIMATE TYPE

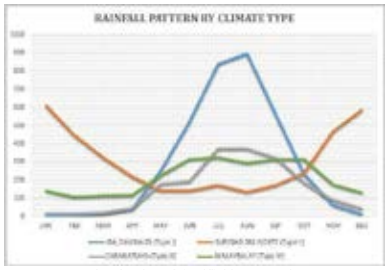
TYPE I : Two pronounced season, dry from November to April and wet during the rest of the year. Maximum rain period is from June to September

TYPE II : No dry season with a very pronounced maximum rain period from December to February. There is not a single dry month. Maximum monthly rainfall occurs during the period from March to May.

TYPE III : No very pronounced maximum rain period, with a dry season lasting only from one to three months, either during the period from December to February or from March to May. This type resembles Type I since it has a short dry season.

TYPE IV : Rainfall is more or less evenly distributed throughout the year. This type resembles Type II since it has no dry season.

Almost whole part of Misamis Occidental classified as climatic Type III and small part in the Western side is climate Type IV.



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LAND SUITABILITY MAP FOR CACAO

LAND RESOURCES EVALUATION AND SUITABILITY ASSESSMENT OF STRATEGIC PRODUCTION AREAS

MISAMIS ORIENTAL, REGION X

EXTENT OF SUITABILITY FOR CACAO PRODUCTION BY MUNICIPALITY

MUNICIPALITY	Existing Cacao (Ha)			TOTAL EXISTING AREA (Ha)	EXPANSION AREA (Ha)						CONFLICT RESOLUTION (Ha)						TOTAL POTENTIAL EXPANSION AREAS (Ha)
					Coconut		Shrubland, unmanaged*		Grassland, unmanaged*		Corn		Mango		Other Crops		
	S1	S2	S3		S1	S2	S1	S2	S1	S2	S1	S2	S1	S2	S1	S2	
ALUBIJID	1	-	1	2	849	393	161	371	66	316	3,160	26	-	-	-	-	5,341
BALINGASAG	3	1	-	4	2,215	655	12	192	33	28	2,240	643	-	-	-	-	5,817
BALINGOAN	3	-	-	3	1,406	26	1	207	177	1,136	197	3	-	-	-	-	3,152
BINUANGAN	-	-	-	-	757	-	-	-	-	-	21	-	-	-	-	-	778
CAGAYAN DE ORO CITY	1	-	-	1	3,282	459	447	717	698	764	3,485	578	8	7	-	-	10,446
CITY OF EL SALVADOR	-	-	-	-	355	646	30	327	14	223	3,277	1,260	-	-	-	-	6,131
CLAVERIA	-	2	1	3	497	1,473	55	1,064	-	303	2,898	9,777	-	-	-	-	16,068
GINGOOG CITY	-	-	-	-	11,283	3,526	470	744	55	347	1,120	1,626	-	-	-	-	19,170
GITAGUM	-	-	-	-	345	-	42	-	-	2	2,444	-	-	-	-	-	2,833
INITAO	-	-	1	1	2,903	1,071	-	-	15	-	525	-	-	-	-	-	4,513
JASAAN	1	-	1	2	1,721	-	14	-	-	-	1,057	-	-	-	-	-	2,791
KINOGUITAN	2	-	-	2	2,295	107	-	21	3	314	222	48	-	-	-	-	3,010
LAGONGLONG	2	-	-	2	500	-	-	-	3	-	605	-	-	-	-	-	1,108
LAGUINDINGAN	1	-	-	1	125	-	-	-	276	-	2,561	-	-	-	-	-	2,961
LIBERTAD	-	-	-	-	822	-	-	-	40	8	826	-	-	-	-	-	1,696
LUGAIT	-	1	1	2	408	1,025	8	2	25	-	-	-	-	-	-	-	1,469
MAGSAYSAY	1	-	-	1	2,304	-	239	-	323	-	386	-	-	-	-	-	3,253
MANTICAO	1	1	-	2	1,407	1,523	7	51	85	19	60	6	-	-	-	-	3,158
MEDINA	-	-	-	-	1,311	1,045	-	54	-	82	2	1	-	-	-	-	2,495
NAAWAN	2	1	-	3	1,374	922	4	19	5.40962966683		101	5	-	-	-	-	2,472
OPOL	-	1	1	2	424	174	65	469	302	2,654	893	543	-	-	-	-	5,524
SALAY	1	-	1	2	1,077	207	-	48	-	531	31	40	-	-	-	-	1,934
SUGBONGCOGON	3	-	-	3	1,320	341	-	-	-	376	58	49	-	-	-	-	2,145
TAGOLOAN	1	-	-	1	445	14	89	2	41	7	833	51	-	-	-	-	1,482
TALISAYAN	-	-	-	-	817	221	840	198	186	229	203	8	-	-	-	-	2,703
VILLANUEVA	-	1	1	2	442	19	12	-	9	2	566	208	-	-	-	-	1,259
TOTAL	22	7	7	36	40,681	13,846	2,498	4,485	2,400	7,341	27,772	14,671	8	7	-	-	113,709

Note: Delivery of cacao planting materials must be started on the onset of rainy season.
**establishment of shade trees prior to planting of cacao.*

AGRONOMIC REQUIREMENT OF CACAO PRODUCTION

LAND UTILIZATION TYPE	SUITABILITY RATING	SLOPE (%)	SOIL DEPTH (cm)	SOIL TEXTURE	SOIL DRAINAGE	SOIL REACTION (pH)	INHERENT FERTILITY	FLOODING CLASS	EROSION CLASS	ROCK OUTCROPS	ELEVATION (masl)	ANNUAL RAINFALL (mm)	CLIMATIC TYPE
Cacao	S1	<8	>100	CL, SiCL, SCL, SC, SiC, C, HC	WD,MWD	5.6 - 7.2	high	none-slight	none-slight	none-few	<1000	2001-4500	I, III, IV
	S2	8 - 30	50 - 100	FSL, L, SiL	SPD,PD	5.1 - 5.5 7.3 - 7.8	medium	moderate	moderate	common	1000-1500	1000-2000	I, II
	S3	>30	<50	S, LS, CSL, SL	VPD,ED	<5.0 - > 7.9	low	severe	severe	many	>1500	<1000 >4500	

SLOPE (%)
0 - 3 - level to gently sloping
3 - 8 - gently sloping to undulating
8 - 18 - undulating to rolling
18 - 30 - rolling to moderately steep
30 - 50 - steep
> 50 - very steep

SOIL DRAINAGE
ED - excessively drained
WD - well drained
MWD - moderately well drained
SPD - somewhat poorly drained
PD - poorly drained
VPD - very poorly drained

SOIL REACTION (pH)
< 4.5 - extremely acid
4.5 - 5.0 - very strongly acid
5.1 - 5.5 - strongly acid
5.6 - 6.0 - medium acid
6.1 - 6.5 - slightly acid
6.6 - 7.2 - neutral
7.3 - 7.8 - mildly alkaline
7.9 - 8.4 - moderately alkaline
> 8.5 - strongly alkaline

SOIL TEXTURE
Coarse
S - sand
LS - loamy sand
CSL - coarse sandy loam
SL - sandy loam
Medium
FSL - fine sandy loam
L - loam
SiL - silt loam
CL - clay loam
SiCL - silty clay loam
SCL - sandy clay loam
Fine
SC - sandy clay
SiC - silty clay
C - clay
HC - heavy clay

SOIL DEPTH (cm)
0 - 30 - very shallow
30 - 50 - shallow
50 - 100 - moderately deep
> 100 - deep to very deep

SURFACE IMPEDIMENT
ROCK OUTCROPS
< 10% - none - few
10 - 30% - common
> 30% - many

LAND LIMITATIONS DESCRIPTION AND COMBINATIONS

ELEVATION
El2 - 1000m - 1500m
El3 - > 1500m

SOIL DRAINAGE
D2 - Somewhat poorly drained to poorly drained
D3 - Very poorly drained or excessively drained

SOIL DEPTH
Sh2 - Moderately deep (50 - 100cm)
Sh3 - Very shallow to shallow (< 50cm)

SOIL EROSION
E2 - Moderate erosion
E3 - Severe erosion

SLOPE/TOPOGRAPHY
T2 - Undulating to moderately steep
T3 - Steep to very steep

SOIL TEXTURE
Tc - Coarse texture

ROCK OUTCROPS
Rc2 - Common
Rc3 - Many

FLOODING
F2 - Moderate seasonal flooding
F3 - Severe seasonal flooding

CODE	LIMITATION	CODE	LIMITATION	CODE	LIMITATION	CODE	LIMITATION	CODE	LIMITATION	CODE	LIMITATION
1	E2-Sh2-Rc2	11	El3-Sh2-Rc2	21	T2-El2	31	T3	41	T3-El2-E3-Sh3-Rc3	51	T3-El2-E3-Rc3
2	El2	12	F2-D2	22	T2-El2-E3	32	T3-E3	42	T3-El3	52	T3-El2-E3-Sh3-Rc3
3	El2-E2-Rc3	13	F2-Tc	23	T2-El2-E3-Rc2	33	T3-E3-Sh2-Rc3	43	T3-El3-E3	53	T3-El3
4	El2-E2-Sh2-Rc3	14	F3-D2	24	T2-El2-E3-Rc3	34	T3-E3-Sh3-Rc2	44	T3-El3-E3-Sh3-Rc2	54	T3-El3-E3-Sh3-Rc3
5	El2-E3-Rc3	15	Sh2-Rc2	25	T2-El2-E3-Sh2-Rc2	35	T3-E3-Sh3-Rc3	45	T3-F3-D2	55	T3-El3
6	El2-E3-Sh2-Rc3	16	T2	26	T2-El2-E3-Sh2-Rc3	36	T3-El2	46	T3	56	Tc
7	El2-Rc2	17	T2-E3	27	T2-El3	37	T3-El2-E3	47	T3-E3		
8	El2-Sh2-Rc2	18	T2-E3-Rc3	28	T2-El3-E3-Sh2-Rc2	38	T3-El2-E3-Rc2	48	T3-E3-Sh3-Rc3		
9	El2-Sh2-Rc3	19	T2-E3-Sh2-Rc2	29	T2-F2-D2	39	T3-El2-E3-Sh2-Rc3	49	T3-El2		
10	El3	20	T2-E3-Sh2-Rc3	30	T2-F3-D2	40	T3-El2-E3-Sh3-Rc2	50	T3-El2-E3		

CODE	LANDUSE
4	Corn
51	Cassava
81	Coffee
82	Cacao
85	Mango
116	Coconut
126	Grassland
134	Shrubs, unmanaged

SUITABILITY CLASSES:

Highly Suitable (S1)
Land having no significant limitation to sustained application of a given use, or only minor limitations that will not significantly reduce productivity or benefits and will not raise inputs above an acceptable level,

Moderately Suitable (S2)
Land having limitation which in aggregate are moderately severe for sustained application of a given use; the limitation will reduce productivity or benefits and increase required inputs to the extent that the overall advantage to be gained from the use, although still attractive, will be appreciably inferior to that expected on class S1 land,

Marginally Suitable (S3)
Land having limitations which in aggregate are severe for sustained application of a given use and will so reduce productivity or benefits, or increase required inputs, that this expenditure will be only marginally justified,

Not Suitable / Not Relevant
Land having limitations which may be surmountable in time but which cannot be corrected with existing knowledge at currently acceptable cost; the limitations are so severe as to preclude successful sustained use of the land in the given manner. Existing forest, shrubland greater than 18% slope, irrigated paddy rice and miscellaneous land types such as built up areas, roads, etc are considered as not relevant,

CLIMATE TYPE

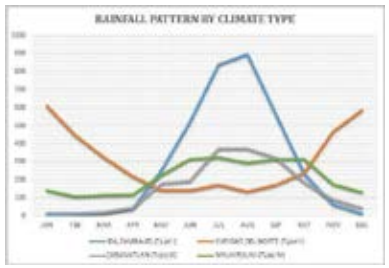
TYPE I : Two pronouced season, dry from November to April and wet during the rest of the year. Maximum rain period is from June to September

TYPE II : No dry season with a very pronounced maximum rain period from December to February. There is not a single dry month. Maximum monthly rainfall occurs during the period from March to May.

TYPE III : No very pronounced maximum rain period, with a dry season lasting only from one to three months, either during the period from December to February or from March to May. This type resembles Type I since it has a short dry season.

TYPE IV : Rainfall is more or less evenly distributed throughout the year. This type resembles Type II since it has no dry season.

Western part of Misamis Oriental is classified as climatic Type III and North Eastern part is climatic Type IV.



Source: PAGASA 2018, *Climatological Normals (Rainfall)*, Philippine Atmospheric, Geophysical and Astronomical Services Administration (PAGASA), accessed 27 July 2018, <https://www1.pagasa.dost.gov.ph/index.php/climate/climatological-normals>.

LAND SUITABILITY MAP FOR CACAO

LAND RESOURCES EVALUATION AND SUITABILITY ASSESSMENT OF STRATEGIC PRODUCTION AREAS

COMPOSTELA VALLEY, REGION XI

EXTENT OF SUITABILITY FOR CACAO PRODUCTION BY MUNICIPALITY

MUNICIPALITY	EXISTING CACAO (Ha)			TOTAL EXISTING AREA (Ha)	EXPANSION AREA (Ha)						CONFLICT RESOLUTION AREA (Ha)										TOTAL POTENTIAL EXPANSION AREA (Ha)
					Coconut		Shrubland, unmanaged*		Grassland, unmanaged*		Banana		Corn		Oil palm		Mango		Other crops		
	S1	S2	S3		S1	S2	S1	S2	S1	S2	S1	S2	S1	S2	S1	S2	S1	S2	S1	S2	
COMPOSTELA	-	-	-	-	2,326	-	78	61	18	7	3,760	-	1,133	-	43	-	-	-	29	-	7,457
LAAK	93	1	18	111	10,778	19,072	3,515	2,699	1,455	1,051	767	568	711	403	-	-	-	-	-	-	41,019
MABINI	-	-	-	-	2,356	8	83	-	250	792	1,223	-	-	-	-	-	-	-	-	-	4,712
MACO	-	-	-	-	4,367	3	157	21	157	1,805	1,197	-	254	-	-	-	-	-	5	-	7,966
MARAGUSAN	-	-	-	-	-	-	-	200	-	-	-	55	-	-	-	-	-	-	-	14	269
MAWAB	-	-	-	-	2,794	34	672	-	954	810	785	2	1,229	5	-	-	21	-	21	-	7,326
MONKAYO	207	61	281	548	12,096	2,397	2,053	-	939	1,411	2,239	-	582	-	71	-	-	-	9	-	21,797
MONTEVISTA	-	-	-	-	2,093	6,135	460	18	185	162	1,037	1	15	7	-	-	-	2	2	2	10,118
NABUNTURAN	-	-	-	-	8,356	193	195	-	705	476	763	19	72	-	182	-	1	-	8	-	10,969
NEW BATAAN	51	-	12	63	5,921	-	388	-	50	240	116	-	306	-	-	-	-	-	-	-	7,022
PANTUKAN	-	-	-	-	6,798	-	90	65	313	1,763	1,153	216	123	-	-	-	51	-	51	-	10,621
TOTAL	350	61	311	722	57,884	27,842	7,691	3,065	5,026	8,517	13,040	860	4,425	415	296	-	73	2	124	15	**129,275**

Note: Delivery of cacao planting materials must be started on the onset of rainy season.
**establishment of shade trees prior to planting of cacao.*

SUITABILITY CLASSES:

Highly Suitable (S1)
Land having no significant limitation to sustained application of a given use, or only minor limitations that will not significantly reduce productivity or benefits and will not raise inputs above an acceptable level.

Moderately Suitable (S2)
Land having limitation which in aggregate are moderately severe for sustained application of a given use; the limitation will reduce productivity or benefits and increase required inputs to the extent that the overall advantage to be gained from the use, although still attractive, will be appreciably inferior to that expected on class S1 land.

Marginally Suitable (S3)
Land having limitations which in aggregate are severe for sustained application of a given use and will so reduce productivity or benefits, or increase required inputs, that this expenditure will be only marginally justified.

Not Suitable / Not Relevant
Land having limitations which may be surmountable in time but which cannot be corrected with existing knowledge at currently acceptable cost; the limitations are so severe as to preclude successful sustained use of the land in the given manner. Existing forest, shrubland greater than 18% slope, irrigated paddy rice and miscellaneous land types such as built up areas, roads, etc are considered as not relevant.

AGRONOMIC REQUIREMENT OF CACAO PRODUCTION

LAND UTILIZATION TYPE	SUITABILITY RATING	SLOPE (%)	SOIL DEPTH (cm)	SOIL TEXTURE	SOIL DRAINAGE	SOIL REACTION (pH)	INHERENT FERTILITY	FLOODING CLASS	EROSION CLASS	ROCK OUTCROPS	ELEVATION (masl)	ANNUAL RAINFALL (mm)	CLIMATIC TYPE
Cacao	S1	<8	>100	CL, SiCL, SCL, SC, SiC, C, HC	WD,MWD	5,6 -7,2	high	none-slight	none-slight	none-few	<1000	2001-4500	I, III, IV
	S2	8 - 30	50 - 100	FSL, L, SiL	SPD,PD	5,1 - 5,5 7,3 - 7,8	medium	moderate	moderate	common	1000-1500	1000-2000	I, II
	S3	>30	<50	S, LS, CSL, SL	VPD,ED	<5.0 - > 7.9	low	severe	severe	many	>1500	<1000 >4500	

SLOPE (%)
0 - 3 - level to gently sloping
3 - 8 - gently sloping to undulating
8 - 18 - undulating to rolling
18 - 30 - rolling to moderately steep
30 - 50 - steep
> 50 - very steep

SOIL DEPTH (cm)
0 - 30 - very shallow
30 - 50 - shallow
50 - 100 - moderately deep
> 100 - deep to very deep

SOIL DRAINAGE
ED - excessively drained
WD - well drained
MWD - moderately well drained
SPD - somewhat poorly drained
PD - poorly drained
VPD - very poorly drained

SURFACE IMPEDIMENT
ROCK OUTCROPS
< 10% - none - few
10 - 30% - common
> 30% - many

SOIL REACTION (pH)
< 4,5 - extremely acid
4,5 - 5,0 - very strongly acid
5,1 - 5,5 - strongly acid
5,6 - 6,0 - medium acid
6,1 - 6,5 - slightly acid
6,6 - 7,2 - neutral
7,3 - 7,8 - mildly alkaline
7,9 - 8,4 - moderately alkaline
> 8,5 - strongly alkaline

SOIL TEXTURE
Coarse
S - sand
LS - loamy sand
CSL - coarse sandy loam
SL - sandy loam
Medium
FSL - fine sandy loam
L - loam
SiL - silt loam
CL - clay loam
SiCL - silty clay loam
SCL - sandy clay loam
Fine
SC - sandy clay
SiC - silty clay
C - clay
HC - heavy clay

CLIMATE TYPE

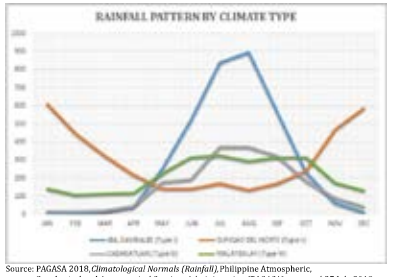
TYPE I : Two pronouced season, dry from November to April and wet during the rest of the year. Maximum rain period is from June to September

TYPE II : No dry season with a very pronounced maximum rain period from December to February. There is not a single dry month. Maximum monthly rainfall occurs during the period from March to May.

TYPE III : No very pronounced maximum rain period, with a dry season lasting only from one to three months, either during the period from December to February or from March to May. This type resembles Type I since it has a short dry season.

TYPE IV : Rainfall is more or less evenly distributed throughout the year. This type resembles Type II since it has no dry season.

Compostella Valley is classified as climatic Type IV.



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LAND LIMITATIONS DESCRIPTION AND COMBINATIONS

ELEVATION
EI2 - 1000m - 1500m
EI3 - > 1500m

SLOPE/TOPOGRAPHY
T2 - Undulating to moderately steep
T3 - Steep to very steep

SOIL DRAINAGE
D2 - Somewhat poorly drained to poorly drained
D3 - Very poorly drained or excessively drained

SOIL TEXTURE
Tc - Coarse texture

SOIL DEPTH
Sh2 - Moderately deep (50 - 100cm)
Sh3 - Very shallow to shallow (< 50cm)

ROCK OUTCROPS
Rc2 - Common
Rc3 - Many

SOIL EROSION
E2 - Moderate erosion
E3 - Severe erosion

FLOODING
F2 - Moderate seasonal flooding
F3 - Severe seasonal flooding

CODE	LIMITATION	CODE	LIMITATION	CODE	LIMITATION	CODE	LIMITATION	CODE	LIMITATION	CODE	LIMITATION
1	E2-Sh2-Rc2	11	F2-D2	21	T2-EI2	31	T3-E3-Rc2	41	T3-EI3-E3-Sh3-Rc2	51	T3-EI3
2	EI2	12	F3-D2	22	T2-EI2-E3	32	T3-E3-Sh3-Rc2	42	T3-EI3-E3-Sh3-Rc3	52	T3-EI3-E3-Sh3-Rc3
3	EI2-E2-Sh2-Rc3	13	Sh2	23	T2-EI2-E3-Rc2	33	T3-E3-Sh3-Rc3	43	T3	53	T3-EI3
4	EI2-E3-Sh2-Rc3	14	Sh2-Rc2	24	T2-EI2-E3-Sh2-Rc2	34	T3-EI2	44	T3-E3		
5	EI2-Rc2	15	T2	25	T2-EI2-E3-Sh2-Rc3	35	T3-EI2-E3	45	T3-E3-Rc3		
6	EI2-Sh2-Rc2	16	T2-E3	26	T2-EI3	36	T3-EI2-E3-Rc2	46	T3-E3-Sh3-Rc3		
7	EI2-Sh2-Rc3	17	T2-E3-Rc2	27	T2-EI3-E3-Sh2-Rc2	37	T3-EI2-E3-Sh2-Rc3	47	T3-EI2		
8	EI3-E3-Sh2-Rc3	18	T2-E3-Rc3	28	T2-EI3-E3-Sh2-Rc3	38	T3-EI2-E3-Sh3-Rc2	48	T3-EI2-E3		
9	EI3-Sh2-Rc2	19	T2-E3-Sh2-Rc2	29	T3	39	T3-EI2-E3-Sh3-Rc3	49	T3-EI2-E3-Rc3		
10	EI3-Sh2-Rc3	20	T2-E3-Sh2-Rc3	30	T3-E3	40	T3-EI3	50	T3-EI2-E3-Sh3-Rc3		

CODE	LANDUSE	CODE	LANDUSE
3	Upland rice	126	Grassland
4	Corn	127	Pasture
81	Coffee	134	Shrubs, unmanaged
82	Cacao	137	Rubber (T)
83	Citrus, calamansi	139	Falcata
85	Mango		
91	Banana		
105	Fruit trees, mixed		
116	Coconut		
119	Oil palm		

LAND SUITABILITY MAP FOR CACAO

LAND RESOURCES EVALUATION AND SUITABILITY ASSESSMENT OF STRATEGIC PRODUCTION AREAS

DAVAO CITY, REGION XI

EXTENT OF SUITABILITY FOR CACAO PRODUCTION BY MUNICIPALITY

MUNICIPALITY	EXISTING CACAO (Ha)			TOTAL EXISTING AREA (Ha)	EXPANSION AREA (Ha)						CONFLICT RESOLUTION AREA (Ha)										TOTAL POTENTIAL EXPANSION AREA (Ha)
					Coconut		Shrubland, unmanaged*		Grassland, unmanaged*		Banana		Mango		Pineapple		Sugarcane		Other crops		
	S1	S2	S3		S1	S2	S1	S2	S1	S2	S1	S2	S1	S2	S1	S2	S1	S2	S1	S2	
DAVAO CITY	154	491	958	1,603	42,559	10,910	2,452	914	7,140	3,780	2,601	2,523	1,187	11	766	553	91	25	437	116	76,063
TOTAL	154	491	958	1,603	42,559	10,910	2,452	914	7,140	3,780	2,601	2,523	1,187	11	766	553	91	25	437	116	76,063

Note: Delivery of cacao planting materials must be started on the onset of rainy season.
**establishment of shade trees prior to planting of cacao.*

AGRONOMIC REQUIREMENT OF CACAO PRODUCTION

LAND UTILIZATION TYPE	SUITABILITY RATING	SLOPE (%)	SOIL DEPTH (cm)	SOIL TEXTURE	SOIL DRAINAGE	SOIL REACTION (pH)	INHERENT FERTILITY	FLOODING CLASS	EROSION CLASS	ROCK OUTCROPS	ELEVATION (masl)	ANNUAL RAINFALL (mm)	CLIMATIC TYPE
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	S3	>30	<50	S, LS, CSL, SL	VPD,ED	<5.0 - > 7.9	low	severe	severe	many	>1500	<1000 >4500	

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SOIL DRAINAGE
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SURFACE IMPEDIMENT
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LAND LIMITATIONS DESCRIPTION AND COMBINATIONS

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EI2 - 1000m - 1500m
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T2 - Undulating to moderately steep
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SOIL DRAINAGE
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SOIL TEXTURE
Tc - Coarse texture

SOIL DEPTH
Sh2 - Moderately deep (50 - 100cm)
Sh3 - Very shallow to shallow (< 50cm)

ROCK OUTCROPS
Rc2 - Common
Rc3 - Many

SOIL EROSION
E2 - Moderate erosion
E3 - Severe erosion

FLOODING
F2 - Moderate seasonal flooding
F3 - Severe seasonal flooding

CODE	LIMITATION	CODE	LIMITATION	CODE	LIMITATION	CODE	LIMITATION	CODE	LIMITATION	CODE	LIMITATION
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2	EI2	12	F3-D2	22	T2-EI2-E3-Rc2	32	T3-E3-Sh3-Rc3	42	T3-E3		
3	EI2-E2-Sh2-Rc3	13	Rc2	23	T2-EI2-E3-Rc3	33	T3-EI2	43	T3-E3-Sh3-Rc3		
4	EI2-E3-Sh2-Rc3	14	Sh2	24	T2-EI2-E3-Sh2-Rc2	34	T3-EI2-E3	44	T3-EI2		
5	EI2-Rc2	15	Sh2-Rc2	25	T2-EI2-E3-Sh2-Rc3	35	T3-EI2-E3-Rc2	45	T3-EI2-E3		
6	EI2-Sh2-Rc2	16	T2	26	T2-EI3-E3	36	T3-EI2-E3-Sh3-Rc2	46	T3-EI2-E3-Rc3		
7	EI2-Sh2-Rc3	17	T2-E3	27	T2-EI3-E3-Sh2-Rc2	37	T3-EI2-E3-Sh3-Rc3	47	T3-EI2-E3-Sh3-Rc3		
8	EI3	18	T2-E3-Sh2-Rc2	28	T2-EI3-E3-Sh2-Rc3	38	T3-EI3	48	T3-EI3		
9	EI3-E3-Sh2-Rc3	19	T2-E3-Sh2-Rc3	29	T3	39	T3-EI3-E3	49	T3-EI3-E3		
10	EI3-Sh2-Rc2	20	T2-EI2	30	T3-E3	40	T3-EI3-E3-Sh3-Rc2	50	T3-EI3-E3-Sh3-Rc3		

CODE	LANDUSE	CODE	LANDUSE
4	Corn	134	Shrubs, unmanaged
34	Diversified crops		
84	Pineapple		
85	Mango		
91	Banana		
105	Fruit trees, mixed		
112	Sugarcane		
116	Coconut		
126	Grassland		
131	ipil ipil		

SUITABILITY CLASSES:

Highly Suitable (S1)
Land having no significant limitation to sustained application of a given use, or only minor limitations that will not significantly reduce productivity or benefits and will not raise inputs above an acceptable level,

Moderately Suitable (S2)
Land having limitation which in aggregate are moderately severe for sustained application of a given use; the limitation will reduce productivity or benefits and increase required inputs to the extent that the overall advantage to be gained from the use, although still attractive, will be appreciably inferior to that expected on class S1 land,

Marginally Suitable (S3)
Land having limitations which in aggregate are severe for sustained application of a given use and will so reduce productivity or benefits, or increase required inputs, that this expenditure will be only marginally justified,

Not Suitable / Not Relevant
Land having limitations which may be surmountable in time but which cannot be corrected with existing knowledge at currently acceptable cost; the limitations are so severe as to preclude successful sustained use of the land in the given manner. Existing forest, shrubland greater than 18% slope, irrigated paddy rice and miscellaneous land types such as built up areas, roads, etc are considered as not relevant,

CLIMATE TYPE

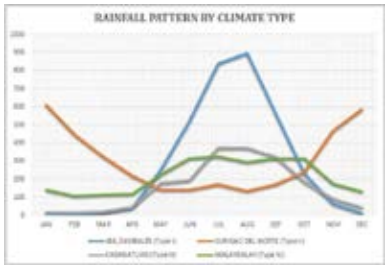
TYPE I : Two pronouced season, dry from November to April and wet during the rest of the year. Maximum rain period is from June to September

TYPE II : No dry season with a very pronounced maximum rain period from December to February. There is not a single dry month. Maximum monthly rainfall occurs during the period from March to May.

TYPE III : No very pronounced maximum rain period, with a dry season lasting only from one to three months, either during the period from December to February or from March to May. This type resembles Type I since it has a short dry season.

TYPE IV : Rainfall is more or less evenly distributed throughout the year. This type resembles Type II since it has no dry season.

Davao City is classified as climatic Type IV.



Source: PAGASA 2018, *Climatological Normals (Rainfall)*, Philippine Atmospheric, Geophysical and Astronomical Services Administration (PAGASA), accessed 27 July 2018, <https://www1.pagasa.dost.gov.ph/index.php/climate/climatological-normals>.

LAND SUITABILITY MAP FOR CACAO

LAND RESOURCES EVALUATION AND SUITABILITY ASSESSMENT OF STRATEGIC PRODUCTION AREAS

DAVAO DEL NORTE, REGION XI

EXTENT OF SUITABILITY FOR CACAO PRODUCTION BY MUNICIPALITY

MUNICIPALITY	EXISTING CACAO (Ha)			TOTAL EXISTING AREA (Ha)	EXPANSION AREA (Ha)						CONFLICT RESOLUTION AREA (Ha)								TOTAL POTENTIAL EXPANSION AREA (Ha)
					Coconut		Shrubland, unmanaged*		Grassland, unmanaged*		Banana		Corn		Mango		Other crops		
	S1	S2	S3		S1	S2	S1	S2	S1	S2	S1	S2	S1	S2	S1	S2	S1	S2	
ASUNCION	-	-	-	-	3,485	69	1,266	-	2,327	5	3,616	169	101	9	36	-	90	-	11,173
BRAULIO E. DUJALI	-	-	-	-	26	-	-	-	123	-	3,280	-	84	-	-	-	-	-	3,513
CARMEN	-	-	-	-	1,318	12	3	-	1,762	6	4,150	-	1,485	-	25	-	234	-	8,995
CITY OF PANABO	33	-	17	50	2,938	353	50	-	687	32	13,629	764	230	-	184	8	244	-	19,119
CITY OF TAGUM	-	-	-	-	9,053	390	-	-	414	47	1,823	83	19	-	-	-	87	13	11,927
ISLAND GARDEN CITY OF SAMAL	-	-	-	-	14,963	3,844	225	24	343	15	7	24	20	-	270	6	4	17	19,761
KAPALONG	-	-	-	-	64	6	2,828	358	4,394	480	6,137	156	134	46	549	3	2	1	15,159
NEW CORELLA	-	-	1	-	1,210	40	436	-	96	1	3,814	-	222	13	18	-	6,359	143	12,352
SAN ISIDRO	-	-	-	-	175	1	1,318	-	5,005	-	6	-	-	-	-	-	160	1	6,667
SANTO TOMAS	-	-	-	-	278	5	1,189	47	1,197	75	8,585	244	552	8	342	-	278	-	12,802
TALAINGOD	-	-	-	-	87	7	560	-	2,809	9	774	12	3	-	-	-	-	-	4,262
TOTAL	33	-	18	**51**	33,597	4,726	7,876	429	19,158	669	45,822	1,452	2,849	76	1,423	16	7,458	175	**125,728**

Note: Delivery of cacao planting materials must be started on the onset of rainy season.
**establishment of shade trees prior to planting of cacao.*

SUITABILITY CLASSES:

Highly Suitable (S1)
Land having no significant limitation to sustained application of a given use, or only minor limitations that will not significantly reduce productivity or benefits and will not raise inputs above an acceptable level.

Marginally Suitable (S3)
Land having limitations which in aggregate are severe for sustained application of a given use and will so reduce productivity or benefits, or increase required inputs, that this expenditure will be only marginally justified.

Moderately Suitable (S2)
Land having limitation which in aggregate are moderately severe for sustained application of a given use; the limitation will reduce productivity or benefits and increase required inputs to the extent that the overall advantage to be gained from the use, although still attractive, will be appreciably inferior to that expected on class S1 land.

Not Suitable / Not Relevant
Land having limitations which may be surmountable in time but which cannot be corrected with existing knowledge at currently acceptable cost; the limitations are so severe as to preclude successful sustained use of the land it the given manner, Existing forest, shrubland greater than 18% slope, irrigated paddy rice and miscellaneous land types such as built up areas, roads, etc are considered as not relevant.

AGRONOMIC REQUIREMENT OF CACAO PRODUCTION

LAND UTILIZATION TYPE	SUITABILITY RATING	SLOPE (%)	SOIL DEPTH (cm)	SOIL TEXTURE	SOIL DRAINAGE	SOIL REACTION (pH)	INHERENT FERTILITY	FLOODING CLASS	EROSION CLASS	ROCK OUTCROPS	ELEVATION (masl)	ANNUAL RAINFALL (mm)	CLIMATIC TYPE
Cacao	S1	<8	>100	CL, SiCL, SCL, SC, SiC, C, HC	WD,MWD	5.6 -7.2	high	none-slight	none-slight	none-few	<1000	2001-4500	I, III, IV
	S2	8 - 30	50 - 100	FSL, L, SiL	SPD,PD	5.1 - 5.5 7.3 - 7.8	medium	moderate	moderate	common	1000-1500	1000-2000	I, II
	S3	>30	<50	S, LS, CSL, SL	VPD,ED	<5.0 - > 7.9	low	severe	severe	many	>1500	<1000 >4500	

SLOPE (%)
0 - 3 - level to gently sloping
3 - 8 - gently sloping to undulating
8 - 18 - undulating to rolling
18 - 30 - rolling to moderately steep
30 - 50 - steep
> 50 - very steep

SOIL DEPTH (cm)
0 - 30 - very shallow
30 - 50 - shallow
50 - 100 - moderately deep
> 100 - deep to very deep

SOIL DRAINAGE
ED - excessively drained
WD - well drained
MWD - moderately well drained
SPD - somewhat poorly drained
PD - poorly drained
VPD - very poorly drained

SURFACE IMPEDIMENT
ROCK OUTCROPS
< 10% - none - few
10 - 30% - common
> 30% - many

SOIL REACTION (pH)
< 4.5 - extremely acid
4.5 - 5.0 - very strongly acid
5.1 - 5.5 - strongly acid
5.6 - 6.0 - medium acid
6.1 - 6.5 - slightly acid
6.6 - 7.2 - neutral
7.3 - 7.8 - mildly alkaline
7.9 - 8.4 - moderately alkaline
> 8.5 - strongly alkaline

SOIL TEXTURE
Coarse
S - sand
LS - loamy sand
CSL - coarse sandy loam
SL - sandy loam
Medium
FSL - fine sandy loam
L - loam
SiL - silt loam
CL - clay loam
SiCL - silty clay loam
SCL - sandy clay loam
Fine
SC - sandy clay
SiC - silty clay
C - clay
HC - heavy clay

CLIMATE TYPE

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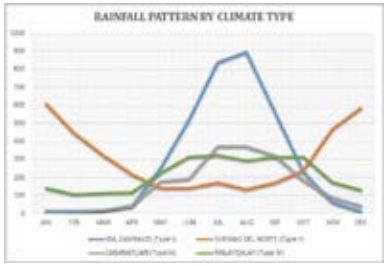
TYPE IV : Rainfall is more or less evenly distributed throughout the year. This type resembles Type II since it has no dry season.

Davao Del Norte is classified as climatic Type IV.



Source: PAGASA 2018, *Climatological Normals (Rainfall)*, Philippine Atmospheric, Geophysical and Astronomical Services Administration (PAGASA), accessed 27 July 2018, <https://www1.pagasa.dost.gov.ph/index.php/climate/climatological-normals>.

LAND LIMITATIONS DESCRIPTION AND COMBINATIONS

ELEVATION
El2 - 1000m - 1500m
El3 - > 1500m

SLOPE/TOPOGRAPHY
T2 - Undulating to moderately steep
T3 - Steep to very steep

SOIL DRAINAGE
D2 - Somewhat poorly drained to poorly drained
D3 - Very poorly drained or excessively drained

SOIL TEXTURE
Tc - Coarse texture

SOIL DEPTH
Sh2 - Moderately deep (50 - 100cm)
Sh3 - Very shallow to shallow (< 50cm)

ROCK OUTCROPS
Rc2 - Common
Rc3 - Many

SOIL EROSION
E2 - Moderate erosion
E3 - Severe erosion

FLOODING
F2 - Moderate seasonal flooding
F3 - Severe seasonal flooding

CODE	LIMITATION	CODE	LIMITATION	CODE	LIMITATION	CODE	LIMITATION
1	E2-Sh2-Rc2	11	T2-E3	21	T3-E3	31	T3-E3-Sh3-Rc3
2	El2	12	T2-E3-Rc3	22	T3-E3-Sh3-Rc2	32	T3-El2
3	El2-Sh2-Rc2	13	T2-E3-Sh2-Rc2	23	T3-E3-Sh3-Rc3	33	T3-El2-E3-Sh3-Rc3
4	El2-Sh2-Rc3	14	T2-E3-Sh2-Rc3	24	T3-El2	34	T3-El3
5	F2-D2	15	T2-El2	25	T3-El2-E3-Rc2		
6	F2-Tc	16	T2-El2-E3-Rc2	26	T3-El2-E3-Sh2-Rc2		
7	F3-D2	17	T2-El2-E3-Sh2-Rc2	27	T3-El2-E3-Sh3-Rc3		
8	Sh2	18	T2-El2-E3-Sh2-Rc3	28	T3-F3-D2		
9	Sh2-Rc2	19	T2-F3-D2	29	T3		
10	T2	20	T3	30	T3-E3		

CODE	LANDUSE	CODE	LANDUSE
4	Corn	134	Shrubs, unmanaged
47	Vegetable	137	Rubber (T)
81	Coffee		
85	Mango		
90	Pomelo		
91	Banana		
105	Fruit trees, mixed		
116	Coconut		
119	Oil palm		
126	Grassland		

LAND SUITABILITY MAP FOR CACAO

LAND RESOURCES EVALUATION AND SUITABILITY ASSESSMENT OF STRATEGIC PRODUCTION AREAS

DAVAO DEL SUR, REGION XI

EXTENT OF SUITABILITY FOR CACAO PRODUCTION BY MUNICIPALITY

MUNICIPALITY	EXISTING CACAO (Ha)			TOTAL EXISTING AREA (Ha)	EXPANSION AREA (Ha)						CONFLICT RESOLUTION AREA (Ha)										TOTAL POTENTIAL EXPANSION AREA (Ha)
					Coconut		Shrubland, unmanaged*		Grassland, unmanaged*		Mango		Banana		Corn		Sugarcane		Other crops		
	S1	S2	S3		S1	S2	S1	S2	S1	S2	S1	S2	S1	S2	S1	S2	S1	S2	S1	S2	
BANSALAN	-	-	-	-	4,705	1,274	4	105	-	-	2,393	129	-	1	24	-	28	-	137	18	8,817
CITY OF DIGOS	-	-	-	-	3,579	-	13	-	39	-	670	-	65	-	47	-	17	-	175	-	4,605
HAGONOY	-	-	-	-	691	-	-	-	-	-	98	-	1,302	16	42	-	13	-	188	77	2,428
KIBLAWAN	-	-	-	-	1,569	-	35	143	162	392	29	-	1,768	-	1,632	-	1,376	14	-	-	7,101
MAGSAYSAY	-	-	-	-	5,435	58	2	7	85	195	423	-	-	-	119	7	-	-	2,034	-	8,365
MALALAG	-	-	-	-	5,603	-	56	-	78	-	127	-	542	-	156	-	21	-	-	-	6,583
MATANAO	-	-	-	-	1,927	-	-	-	145	109	4,038	-	18	-	555	-	706	-	68	-	7,566
PADADA	-	-	-	-	1,672	-	-	-	-	-	30	-	757	-	72	-	-	-	-	-	2,531
SANTA CRUZ	-	-	-	-	5,234	179	-	-	59	9	1	-	211	-	-	-	-	-	877	-	6,569
SULOP	-	-	-	-	5,317	138	146	-	10	-	139	-	1,567	-	160	-	61	2	-	-	7,536
TOTAL	-	-	-	-	35,713	1,649	256	255	579	704	7,943	129	6,229	17	2,807	7	2,222	16	3,479	94	**62,101**

Note: Delivery of cacao planting materials must be started on the onset of rainy season.
**establishment of shade trees prior to planting of cacao.*

SUITABILITY CLASSES:

Highly Suitable (S1)
Land having no significant limitation to sustained application of a given use, or only minor limitations that will not significantly reduce productivity or benefits and will not raise inputs above an acceptable level.

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AGRONOMIC REQUIREMENT OF CACAO PRODUCTION

LAND UTILIZATION TYPE	SUITABILITY RATING	SLOPE (%)	SOIL DEPTH (cm)	SOIL TEXTURE	SOIL DRAINAGE	SOIL REACTION (pH)	INHERENT FERTILITY	FLOODING CLASS	EROSION CLASS	ROCK OUTCROPS	ELEVATION (masl)	ANNUAL RAINFALL (mm)	CLIMATIC TYPE
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Coarse
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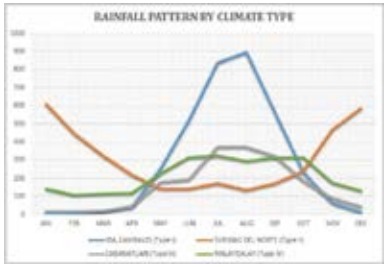

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LAND LIMITATIONS DESCRIPTION AND COMBINATIONS

ELEVATION
EI2 - 1000m - 1500m
EI3 - > 1500m

SOIL DRAINAGE
D2 - Somewhat poorly drained to poorly drained
D3 - Very poorly drained or excessively drained

SOIL DEPTH
Sh2 - Moderately deep (50 - 100cm)
Sh3 - Very shallow to shallow (< 50cm)

SOIL EROSION
E2 - Moderate erosion
E3 - Severe erosion

SLOPE/TOPOGRAPHY
T2 - Undulating to moderately steep
T3 - Steep to very steep

SOIL TEXTURE
Tc - Coarse texture

ROCK OUTCROPS
Rc2 - Common
Rc3 - Many

FLOODING
F2 - Moderate seasonal flooding
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CODE	LIMITATION	CODE	LIMITATION	CODE	LIMITATION	CODE	LIMITATION	CODE	LIMITATION
1	E2-Sh2-Rc2	11	Sh2-Rc2	21	T2-EI3-E3	31	T3-EI2-E3	41	T3-EI2
2	EI2	12	T2	22	T2-EI3-E3-Sh2-Rc2	32	T3-EI2-E3-Sh3-Rc2	42	T3-EI2-E3
3	EI2-Sh2-Rc2	13	T2-E3	23	T2-F2-D2	33	T3-EI2-E3-Sh3-Rc3	43	T3-EI2-E3-Sh3-Rc3
4	EI2-Sh2-Rc3	14	T2-E3-Rc2	24	T2-F3-D2	34	T3-EI3-E3-Sh3-Rc2	44	T3-EI3-E3-Sh3-Rc3
5	EI3	15	T2-E3-Sh2-Rc2	25	T3	35	T3-F2-D2	45	T3-EI3
6	EI3-Sh2-Rc2	16	T2-E3-Sh2-Rc3	26	T3-E3	36	T3-F3-D2	46	Tc
7	F2-D2	17	T2-EI2	27	T3-E3-Rc2	37	T3		
8	F2-Tc	18	T2-EI2-E3	28	T3-E3-Sh3-Rc2	38	T3-E3		
9	F3-D2	19	T2-EI2-E3-Sh2-Rc2	29	T3-E3-Sh3-Rc3	39	T3-E3-Rc3		
10	Sh2	20	T2-EI2-E3-Sh2-Rc3	30	T3-EI2	40	T3-E3-Sh3-Rc3		

CODE	LANDUSE	CODE	LANDUSE
4	Corn	105	Fruit trees, mixed
34	Diversified crops	107	Abaca
50	Rootcrops	112	Sugarcane
81	Coffee	116	Coconut
84	Pineapple	126	Grassland
85	Mango	134	Shrubs, unmanaged
89	Durian	137	Rubber (T)
90	Pomelo		
91	Banana		
93	Mangosteen		

LAND SUITABILITY MAP FOR CACAO

LAND RESOURCES EVALUATION AND SUITABILITY ASSESSMENT OF STRATEGIC PRODUCTION AREAS

DAVAO OCCIDENTAL, REGION XI

EXTENT OF SUITABILITY FOR CACAO PRODUCTION BY MUNICIPALITY

MUNICIPALITY	EXISTING CACAO (Ha)			TOTAL EXISTING AREA (Ha)	EXPANSION AREA (Ha)						CONFLICT RESOLUTION AREA (Ha)						TOTAL POTENTIAL EXPANSION AREA (Ha)
					Coconut		Shrubland, unmanaged*		Grassland, unmanaged*		Banana		Corn		Other crops		
	S1	S2	S3		S1	S2	S1	S2	S1	S2	S1	S2	S1	S2	S1	S2	
DON MARCELINO	-	-	-	-	969	481	-	-	122	1	40	41	-	-	-	-	1,653
JOSE ABAD SANTOS	-	-	-	-	2,794	212	1	4	720	-	1	-	21	-	1	-	3,754
MALITA	-	-	-	-	3,904	2,194	36	12	497	394	92	398	80	-	30	123	7,760
SANTA MARIA	-	-	-	-	5,127	-	-	-	361	7	-	-	-	-	17	-	5,512
SARANGANI	-	-	-	-	2,247	64	-	-	-	-	-	-	-	-	-	-	2,311
TOTAL	-	-	-	-	15,041	2,951	38	16	1,699	401	133	438	101	-	47	123	**20,989**

Note: Delivery of cacao planting materials must be started on the onset of rainy season.
**establishment of shade trees prior to planting of cacao.*

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AGRONOMIC REQUIREMENT OF CACAO PRODUCTION

LAND UTILIZATION TYPE	SUITABILITY RATING	SLOPE (%)	SOIL DEPTH (cm)	SOIL TEXTURE	SOIL DRAINAGE	SOIL REACTION (pH)	INHERENT FERTILITY	FLOODING CLASS	EROSION CLASS	ROCK OUTCROPS	ELEVATION (masl)	ANNUAL RAINFALL (mm)	CLIMATIC TYPE
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L - loam
SiL - silt loam
CL - clay loam
SiCL - silty clay loam
SCL - sandy clay loam
Fine
SC - sandy clay
SiC - silty clay
C - clay
HC - heavy clay

CLIMATE TYPE

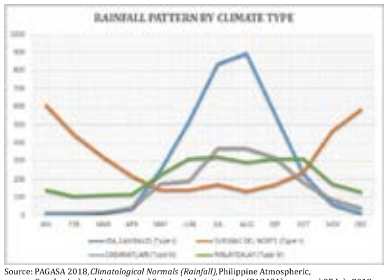
TYPE I : Two pronouced season, dry from November to April and wet during the rest of the year. Maximum rain period is from June to September

TYPE II : No dry season with a very pronounced maximum rain period from December to February, There is not a single dry month. Maximum monthly rainfall occurs during the period from March to May.

TYPE III : No very pronounced maximum rain period, with a dry season lasting only from one to three months, either during the period from December to February or from March to May. This type resembles Type I since it has a short dry season.

TYPE IV : Rainfall is more or less evenly distributed throughout the year. This type resembles Type II since it has no dry season.

Davao Occidental is classified as climatic Type IV.



Source: PAGASA 2018, *Climatological Normals (Rainfall)*, Philippine Atmospheric, Geophysical and Astronomical Services Administration (PAGASA), accessed 27 July 2018, <https://www1.pagasa.dost.gov.ph/index.php/climate/climatological-normals>.

LAND LIMITATIONS DESCRIPTION AND COMBINATIONS

ELEVATION
EI2 - 1000m - 1500m
EI3 - > 1500m

SLOPE/TOPOGRAPHY
T2 - Undulating to moderately steep
T3 - Steep to very steep

SOIL DRAINAGE
D2 - Somewhat poorly drained to poorly drained
D3 - Very poorly drained or excessively drained

SOIL TEXTURE
Tc - Coarse texture

SOIL DEPTH
Sh2 - Moderately deep (50 - 100cm)
Sh3 - Very shallow to shallow (< 50cm)

ROCK OUTCROPS
Rc2 - Common
Rc3 - Many

SOIL EROSION
E2 - Moderate erosion
E3 - Severe erosion

FLOODING
F2 - Moderate seasonal flooding
F3 - Severe seasonal flooding

CODE	LIMITATION	CODE	LIMITATION	CODE	LIMITATION	CODE	LIMITATION	CODE	LIMITATION
1	E2-Sh2-Rc2	11	T2-E3-Rc2	21	T2-F2-D2	31	T3-EI2-E3-Sh3-Rc2	41	T3-EI2
2	EI2	12	T2-E3-Sh2-Rc2	22	T2-F3-D2	32	T3-EI2-E3-Sh3-Rc3	42	T3-EI2-E3
3	EI2-E3-Rc3	13	T2-E3-Sh2-Rc3	23	T3	33	T3-EI3-E3-Sh2-Rc3	43	T3-EI2-E3-Sh3-Rc3
4	EI2-Sh2-Rc2	14	T2-EI2	24	T3-E3	34	T3-EI3-E3-Sh3-Rc2	44	T3-EI3-E3-Sh3-Rc3
5	F2-D2	15	T2-EI2-E3	25	T3-E3-Rc2	35	T3-F2-D2	45	T3-EI3
6	F2-Tc	16	T2-EI2-E3-Rc3	26	T3-E3-Sh3-Rc2	36	T3-F3-D2	46	Tc
7	F3-D2	17	T2-EI2-E3-Sh2-Rc2	27	T3-E3-Sh3-Rc3	37	T3		
8	Sh2	18	T2-EI2-E3-Sh2-Rc3	28	T3-EI2	38	T3-E3		
9	T2	19	T2-EI3-Rc3	29	T3-EI2-E3	39	T3-E3-Rc3		
10	T2-E3	20	T2-EI3-E3-Sh2-Rc2	30	T3-EI2-E3-Sh2-Rc3	40	T3-E3-Sh3-Rc3		

CODE	LANDUSE
4	Corn
34	Diversified crops
85	Mango
89	Durian
91	Banana
107	Abaca
116	Coconut
126	Grassland
134	Shrubs, unmanaged
137	Rubber (T)

LAND SUITABILITY MAP FOR CACAO

LAND RESOURCES EVALUATION AND SUITABILITY ASSESSMENT OF STRATEGIC PRODUCTION AREAS

DAVAO ORIENTAL, REGION XI

EXTENT OF SUITABILITY FOR CACAO PRODUCTION BY MUNICIPALITY

MUNICIPALITY	EXISTING CACAO (Ha)			TOTAL EXISTING AREA (Ha)	EXPANSION AREA (Ha)						CONFLICT RESOLUTION AREA (Ha)								TOTAL POTENTIAL EXPANSION AREA (Ha)
					Coconut		Shrubland, unmanaged*		Grassland, unmanaged*		Banana		Corn		Mango		Other crops		
	S1	S2	S3		S1	S2	S1	S2	S1	S2	S1	S2	S1	S2	S1	S2	S1	S2	
BAGANGA	94	8	-	102	1,123	197	6,439	4,445	26	26	2,258	2,605	59	21	-	-	4	2	17,204
BANAYBANAY	-	-	-	-	2,272	11	77	141	883	94	70	-	20	-	3	-	1	-	3,572
BOSTON	1	-	12	13	1,122	-	2,066	26	245	-	-	-	73	-	-	-	-	-	3,532
CARAGA	287	628	-	915	1,496	1,139	96	260	509	203	-	-	-	-	-	-	-	-	3,703
CATEEL	12	5	1,851	1,868	1,846	175	6,474	1,975	573	88	669	685	369	7	-	-	-	-	12,861
CITY OF MATI	1	-	39	40	10,315	2,026	518	27	474	77	363	33	451	67	651	-	2,588	251	17,840
GOVERNOR GENEROSO	-	-	-	-	3,509	-	672	-	730	-	549	-	20	-	1	-	-	-	5,481
LUPON	-	-	10	10	4,154	62	1,290	70	150	62	4,546	34	184	-	9	-	10	-	10,572
MANAY	1	13	-	14	4,150	2,587	31	21	1,869	1,819	-	-	-	-	-	-	-	-	10,477
SAN ISIDRO	-	-	-	-	3,154	675	-	-	362	100	332	9	78	18	266	-	-	-	4,993
TARRAGONA	-	-	1	1	74	231	-	11	451	255	19	42	103	78	7	-	-	1	1,273
TOTAL	396	654	1,913	**2,963**	33,215	7,103	17,663	6,976	6,271	2,724	8,806	3,408	1,357	190	937	-	2,603	255	**91,508**

Note: Delivery of cacao planting materials must be started on the onset of rainy season.
**establishment of shade trees prior to planting of cacao.*

SUITABILITY CLASSES:

Highly Suitable (S1)
Land having no significant limitation to sustained application of a given use, or only minor limitations that will not significantly reduce productivity or benefits and will not raise inputs above an acceptable level.

Marginally Suitable (S3)
Land having limitations which in aggregate are severe for sustained application of a given use and will so reduce productivity or benefits, or increase required inputs, that this expenditure will be only marginally justified.

Moderately Suitable (S2)
Land having limitation which in aggregate are moderately severe for sustained application of a given use; the limitation will reduce productivity or benefits and increase required inputs to the extent that the overall advantage to be gained from the use, although still attractive, will be appreciably inferior to that expected on class S1 land.

Not Suitable / Not Relevant
Land having limitations which may be surmountable in time but which cannot be corrected with existing knowledge at currently acceptable cost; the limitations are so severe as to preclude successful sustained use of the land in the given manner. Existing forest, shrubland greater than 18% slope, irrigated paddy rice and miscellaneous land types such as built up areas, roads, etc are considered as not relevant.

AGRONOMIC REQUIREMENT OF CACAO PRODUCTION

LAND UTILIZATION TYPE	SUITABILITY RATING	SLOPE (%)	SOIL DEPTH (cm)	SOIL TEXTURE	SOIL DRAINAGE	SOIL REACTION (pH)	INHERENT FERTILITY	FLOODING CLASS	EROSION CLASS	ROCK OUTCROPS	ELEVATION (masl)	ANNUAL RAINFALL (mm)	CLIMATIC TYPE
Cacao	S1	<8	>100	CL, SiCL, SCL, SC, SiC, C, HC	WD,MWD	5.6 - 7.2	high	none-slight	none-slight	none-few	<1000	2001-4500	I, III, IV
	S2	8 - 30	50 - 100	FSL, L, SiL	SPD,PD	5.1 - 5.5 7.3 - 7.8	medium	moderate	moderate	common	1000-1500	1000-2000	I, II
	S3	>30	<50	S, LS, CSL, SL	VPD,ED	<5.0 - > 7.9	low	severe	severe	many	>1500	<1000 >4500	

SLOPE (%)
0 - 3 - level to gently sloping
3 - 8 - gently sloping to undulating
8 - 18 - undulating to rolling
18 - 30 - rolling to moderately steep
30 - 50 - steep
> 50 - very steep

SOIL DEPTH (cm)
0 - 30 - very shallow
30 - 50 - shallow
50 - 100 - moderately deep
> 100 - deep to very deep

SOIL DRAINAGE
ED - excessively drained
WD - well drained
MWD - moderately well drained
SPD - somewhat poorly drained
PD - poorly drained
VPD - very poorly drained

SURFACE IMPEDIMENT
ROCK OUTCROPS
< 10% - none - few
10 - 30% - common
> 30% - many

SOIL REACTION (pH)
< 4.5 - extremely acid
4.5 - 5.0 - very strongly acid
5.1 - 5.5 - strongly acid
5.6 - 6.0 - medium acid
6.1 - 6.5 - slightly acid
6.6 - 7.2 - neutral
7.3 - 7.8 - mildly alkaline
7.9 - 8.4 - moderately alkaline
> 8.5 - strongly alkaline

SOIL TEXTURE
Coarse
S - sand
LS - loamy sand
CSL - coarse sandy loam
SL - sandy loam
Medium
FSL - fine sandy loam
L - loam
SiL - silt loam
CL - clay loam
SiCL - silty clay loam
SCL - sandy clay loam
Fine
SC - sandy clay
SiC - silty clay
C - clay
HC - heavy clay

CLIMATE TYPE

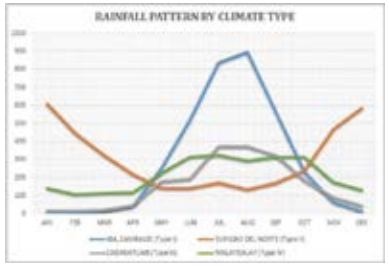
TYPE I : Two pronounced season, dry from November to April and wet during the rest of the year, Maximum rain period is from June to September

TYPE II : No dry season with a very pronounced maximum rain period from December to February. There is not a single dry month. Maximum monthly rainfall occurs during the period from March to May.

TYPE III : No very pronounced maximum rain period, with a dry season lasting only from one to three months, either during the period from December to February or from March to May. This type resembles Type I since it has a short dry season.

TYPE IV : Rainfall is more or less evenly distributed throughout the year. This type resembles Type II since it has no dry season.

Davao Oriental is classified as climatic Type IV.



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LAND LIMITATIONS DESCRIPTION AND COMBINATIONS

ELEVATION
El2 - 1000m - 1500m
El3 - > 1500m

SOIL DRAINAGE
D2 - Somewhat poorly drained to poorly drained
D3 - Very poorly drained or excessively drained

SOIL DEPTH
Sh2 - Moderately deep (50 - 100cm)
Sh3 - Very shallow to shallow (< 50cm)

SOIL EROSION
E2 - Moderate erosion
E3 - Severe erosion

SLOPE/TOPOGRAPHY
T2 - Undulating to moderately steep
T3 - Steep to very steep

SOIL TEXTURE
Tc - Coarse texture

ROCK OUTCROPS
Rc2 - Common
Rc3 - Many

FLOODING
F2 - Moderate seasonal flooding
F3 - Severe seasonal flooding

CODE	LIMITATION	CODE	LIMITATION	CODE	LIMITATION	CODE	LIMITATION	CODE	LIMITATION	CODE	LIMITATION	CODE	LIMITATION
1	E2	11	El3-E3-Sh2-Rc3	21	T2-E3-Rc2	31	T2-El3-E3-Rc3	41	T3-E3-Sh3-Rc3	51	T3-F2-D2	61	T3-El2-E3-Sh3-Rc3
2	E2-Sh2-Rc2	12	El3-Sh2-Rc2	22	T2-E3-Rc3	32	T2-El3-E3-Sh2-Rc2	42	T3-El2	52	T3-F3-D2	62	T3-F2-D2
3	El2	13	El3-Sh2-Rc3	23	T2-E3-Sh2-Rc2	33	T2-El3-E3-Sh2-Rc3	43	T3-El2-E3	53	T3	63	T3-F3-D2
4	El2-E2-Rc3	14	F2-D2	24	T2-E3-Sh2-Rc3	34	T2-F2-D2	44	T3-El2-E3-Rc2	54	T3-E3	64	T3-El3
5	El2-E2-Sh2-Rc3	15	F3-D2	25	T2-El2	35	T2-F3-D2	45	T3-El2-E3-Sh2-Rc3	55	T3-E3-Rc3	65	Tc
6	El2-E3-Rc3	16	Rc2	26	T2-El2-E3	36	T3	46	T3-El2-E3-Sh3-Rc2	56	T3-E3-Sh3-Rc3		
7	El2-E3-Sh2-Rc3	17	Sh2	27	T2-El2-E3-Rc2	37	T3-E3	47	T3-El2-E3-Sh3-Rc3	57	T3-El2		
8	El2-Rc2	18	Sh2-Rc2	28	T2-El2-E3-Rc3	38	T3-E3-Rc2	48	T3-El3-E3-Sh2-Rc3	58	T3-El2-E3		
9	El2-Sh2-Rc2	19	T2	29	T2-El2-E3-Sh2-Rc2	39	T3-E3-Sh2-Rc3	49	T3-El3-E3-Sh3-Rc2	59	T3-El2-E3-Rc3		
10	El2-Sh2-Rc3	20	T2-E3	30	T2-El2-E3-Sh2-Rc3	40	T3-E3-Sh3-Rc2	50	T3-El3-E3-Sh3-Rc3	60	T3-El2-E3-Sh3-Rc3		

CODE	LANDUSE	CODE	LANDUSE
4	Corn	107	Abaca
47	Vegetable	116	Coconut
50	Rootcrops	126	Grassland
51	Cassava	134	Shrubs, unmanaged
81	Coffee	137	Rubber
82	Cacao		
85	Mango		
90	Pomelo		
91	Banana		
105	Fruit trees, mixed		

LAND SUITABILITY MAP FOR CACAO

LAND RESOURCES EVALUATION AND SUITABILITY ASSESSMENT OF STRATEGIC PRODUCTION AREAS

COTABATO CITY, REGION XII

EXTENT OF SUITABILITY FOR CACAO PRODUCTION BY MUNICIPALITY

MUNICIPALITY	EXISTING CACAO (Ha)			TOTAL EXISTING AREA (Ha)	EXPANSION AREA (Ha)						CONFLICT RESOLUTION AREA (Ha)						TOTAL POTENTIAL EXPANSION AREA (Ha)
					Coconut		Shrubland, unmanaged*		Grassland, unmanaged*		Corn		Paddy rice, non-irrigated		Other crops		
	S1	S2	S3		S1	S2	S1	S2	S1	S2	S1	S2	S1	S2	S1	S2	
COTABATO CITY	-	-	-	-	-	-	4	-	-	-	-	-	-	-	-	-	4
TOTAL	-	-	-	-	-	-	4	-	-	-	-	-	-	-	-	-	4

Note: Delivery of cacao planting materials must be started on the onset of rainy season.
**establishment of shade trees prior to planting of cacao.*

AGRONOMIC REQUIREMENT OF CACAO PRODUCTION

LAND UTILIZATION TYPE	SUITABILITY RATING	SLOPE (%)	SOIL DEPTH (cm)	SOIL TEXTURE	SOIL DRAINAGE	SOIL REACTION (pH)	INHERENT FERTILITY	FLOODING CLASS	EROSION CLASS	ROCK OUTCROPS	ELEVATION (masl)	ANNUAL RAINFALL (mm)	CLIMATIC TYPE
Cacao	S1	<8	>100	CL, SiCL, SCL, SC, SiC, C, HC	WD,MWD	5.6 -7.2	high	none-slight	none-slight	none-few	<1000	2001-4500	I, III, IV
	S2	8 - 30	50 - 100	FSL, L, SiL	SPD,PD	5.1 - 5.5 7,3 - 7,8	medium	moderate	moderate	common	1000-1500	1000-2000	I, II
	S3	>30	<50	S, LS, CSL, SL	VPD,ED	<5,0 - > 7.9	low	severe	severe	many	>1500	<1000 >4500	

SLOPE (%)
0 - 3 - level to gently sloping
3 - 8 - gently sloping to undulating
8 - 18 - undulating to rolling
18 - 30 - rolling to moderately steep
30 - 50 - steep
> 50 - very steep

SOIL DEPTH (cm)
0 - 30 - very shallow
30 - 50 - shallow
50 - 100 - moderately deep
> 100 - deep to very deep

SOIL DRAINAGE
ED - excessively drained
WD - well drained
MWD - moderately well drained
SPD - somewhat poorly drained
PD - poorly drained
VPD - very poorly drained

SURFACE IMPEDIMENT
ROCK OUTCROPS
< 10% - none - few
10 - 30% - common
> 30% - many

SOIL REACTION (pH)
< 4,5 - extremely acid
4,5 - 5,0 - very strongly acid
5,1 - 5,5 - strongly acid
5,6 - 6,0 - medium acid
6,1 - 6,5 - slightly acid
6,6 - 7,2 - neutral
7,3 - 7,8 - mildly alkaline
7,9 - 8,4 - moderately alkaline
> 8,5 - strongly alkaline

SOIL TEXTURE
Coarse
S - sand
LS - loamy sand
CSL - coarse sandy loam
SL - sandy loam
Medium
FSL - fine sandy loam
L - loam
SiL - silt loam
CL - clay loam
SiCL - silty clay loam
SCL - sandy clay loam
Fine
SC - sandy clay
SiC - silty clay
C - clay
HC - heavy clay

LAND LIMITATIONS DESCRIPTION AND COMBINATIONS

ELEVATION
El2 - 1000m - 1500m
El3 - > 1500m

SLOPE/TOPOGRAPHY
T2 - Undulating to moderately steep
T3 - Steep to very steep

SOIL DRAINAGE
D2 - Somewhat poorly drained to poorly drained
D3 - Very poorly drained or excessively drained

SOIL TEXTURE
Tc - Coarse texture

SOIL DEPTH
Sh2 - Moderately deep (50 - 100cm)
Sh3 - Very shallow to shallow (< 50cm)

ROCK OUTCROPS
Rc2 - Common
Rc3 - Many

SOIL EROSION
E2 - Moderate erosion
E3 - Severe erosion

FLOODING
F2 - Moderate seasonal flooding
F3 - Severe seasonal flooding

CODE	LIMITATION	CODE	LIMITATION
1	F2-D2	11	T3-El3
2	F2-Tc		
3	F3-D2		
4	T2		
5	T2-F2-D2		
6	T2-F3-D2		
7	T3		
8	T3-F2-D2		
9	T3-F3-D2		
10	T3-F3-D2		

CODE	LANDUSE
116	Coconut
134	Shrubs, unmanaged

SUITABILITY CLASSES:

Highly Suitable (S1)
Land having no significant limitation to sustained application of a given use, or only minor limitations that will not significantly reduce productivity or benefits and will not raise inputs above an acceptable level.

Marginally Suitable (S3)
Land having limitations which in aggregate are severe for sustained application of a given use and will so reduce productivity or benefits, or increase required inputs, that this expenditure will be only marginally justified.

Moderately Suitable (S2)
Land having limitation which in aggregate are moderately severe for sustained application of a given use; the limitation will reduce productivity or benefits and increase required inputs to the extent that the overall advantage to be gained from the use, although still attractive, will be appreciably inferior to that expected on class S1 land,

Not Suitable / Not Relevant
Land having limitations which may be surmountable in time but which cannot be corrected with existing knowledge at currently acceptable cost; the limitations are so severe as to preclude successful sustained use of the land in the given manner. Existing forest, shrubland greater than 18% slope, irrigated paddy rice and miscellaneous land types such as built up areas, roads, etc are considered as not relevant.

CLIMATE TYPE

TYPE I : Two pronouced season, dry from November to April and wet during the rest of the year. Maximum rain period is from June to September

TYPE II : No dry season with a very pronounced maximum rain period from December to February. There is not a single dry month. Maximum monthly rainfall occurs during the period from March to May.

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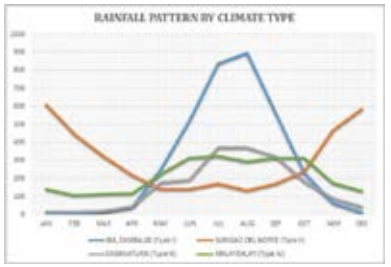
TYPE IV : Rainfall is more or less evenly distributed throughout the year. This type resembles Type II since it has no dry season.

Western part of Catabato City is classified as climatic Type IV and Eastern part is Type III.



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LAND SUITABILITY MAP FOR CACAO

LAND RESOURCES EVALUATION AND SUITABILITY ASSESSMENT OF STRATEGIC PRODUCTION AREAS

GENERAL SANTOS CITY, REGION XII

EXTENT OF SUITABILITY FOR CACAO PRODUCTION BY MUNICIPALITY

MUNICIPALITY	EXISTING CACAO (Ha)			TOTAL EXISTING AREA (Ha)	EXPANSION AREA (Ha)						CONFLICT RESOLUTION AREA (Ha)						TOTAL POTENTIAL EXPANSION AREA (Ha)
					Coconut		Shrubland, unmanaged*		Grassland, unmanaged*		Corn		Pineapple		Other crops		
	S1	S2	S3		S1	S2	S1	S2	S1	S2	S1	S2	S1	S2	S1	S2	
GENERAL SANTOS CITY	-	-	-	-	2,785	51	593	29	4001	3,388	7,296	1,826	99	12	3		20,084
TOTAL	-	-	-	-	2,785	51	593	29	4001	3,388	7,296	1,826	99	12	3		**20,084**

Note: Delivery of cacao planting materials must be started on the onset of rainy season.
**establishment of shade trees prior to planting of cacao.*

SUITABILITY CLASSES:

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AGRONOMIC REQUIREMENT OF CACAO PRODUCTION

LAND UTILIZATION TYPE	SUITABILITY RATING	SLOPE (%)	SOIL DEPTH (cm)	SOIL TEXTURE	SOIL DRAINAGE	SOIL REACTION (pH)	INHERENT FERTILITY	FLOODING CLASS	EROSION CLASS	ROCK OUTCROPS	ELEVATION (masl)	ANNUAL RAINFALL (mm)	CLIMATIC TYPE
Cacao	S1	<8	>100	CL, SiCL, SCL, SC, SiC, C, HC	WD,MWD	5.6 -7.2	high	none-slight	none-slight	none-few	<1000	2001-4500	I, III, IV
	S2	8 - 30	50 - 100	FSL, L, SiL	SPD,PD	5.1 - 5.5 7.3 - 7.8	medium	moderate	moderate	common	1000-1500	1000-2000	I, II
	S3	>30	<50	S, LS, CSL, SL	VPD,ED	<5.0 - > 7.9	low	severe	severe	many	>1500	<1000 >4500	

SLOPE (%)
0 - 3 - level to gently sloping
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30 - 50 - steep
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SOIL DRAINAGE
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WD - well drained
MWD - moderately well drained
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SOIL REACTION (pH)
< 4.5 - extremely acid
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6.1 - 6.5 - slightly acid
6.6 - 7.2 - neutral
7.3 - 7.8 - mildly alkaline
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SOIL TEXTURE
Coarse
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LS - loamy sand
CSL - coarse sandy loam
SL - sandy loam
Medium
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SiL - silt loam
CL - clay loam
SiCL - silty clay loam
SCL - sandy clay loam
Fine
SC - sandy clay
SiC - silty clay
C - clay
HC - heavy clay

SOIL DEPTH (cm)
0 - 30 - very shallow
30 - 50 - shallow
50 - 100 - moderately deep
> 100 - deep to very deep

SURFACE IMPEDIMENT
ROCK OUTCROPS
< 10% - none - few
10 - 30% - common
> 30% - many

CLIMATE TYPE

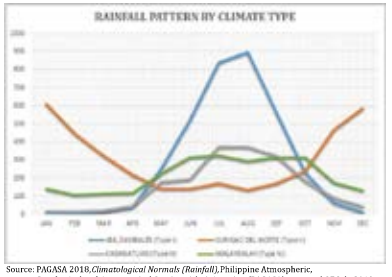
TYPE I : Two pronouced season, dry from November to April and wet during the rest of the year, Maximum rain period is from June to September

TYPE II : No dry season with a very pronounced maximum rain period from December to February. There is not a single dry month. Maximum monthly rainfall occurs during the period from March to May.

TYPE III : No very pronounced maximum rain period, with a dry season lasting only from one to three months, either during the period from December to February or from March to May. This type resembles Type I since it has a short dry season.

TYPE IV : Rainfall is more or less evenly distributed throughout the year. This type resembles Type II since it has no dry season.

General Santos City is classified as climatic Type IV.



Source: PAGASA 2018, *Climatological Normals (Rainfall)*, Philippine Atmospheric, Geophysical and Astronomical Services Administration (PAGASA), accessed 27 July 2018, <https://www1.pagasa.dost.gov.ph/index.php/climate/climatological-normals>.

LAND LIMITATIONS DESCRIPTION AND COMBINATIONS

ELEVATION
E2 - 1000m - 1500m
E3 - > 1500m

SOIL DRAINAGE
D2 - Somewhat poorly drained to poorly drained
D3 - Very poorly drained or excessively drained

SOIL DEPTH
Sh2 - Moderately deep (50 - 100cm)
Sh3 - Very shallow to shallow (< 50cm)

SOIL EROSION
E2 - Moderate erosion
E3 - Severe erosion

SLOPE/TOPOGRAPHY
T2 - Undulating to moderately steep
T3 - Steep to very steep

SOIL TEXTURE
Tc - Coarse texture

ROCK OUTCROPS
Rc2 - Common
Rc3 - Many

FLOODING
F2 - Moderate seasonal flooding
F3 - Severe seasonal flooding

CODE	LIMITATION	CODE	LIMITATION	CODE	LIMITATION
1	E2-Sh2-Rc2	11	T2-E3-Sh2-Rc3	21	T3-E3-Sh3-Rc3
2	E12	12	T2-E12	22	T3-E12-E3-Sh3-Rc3
3	E12-Rc2	13	T2-E12-E3-Sh2-Rc2	23	T3-E13
4	E12-Sh2-Rc2	14	T3	24	Tc
5	F2-D2	15	T3-E3		
6	F3-D2	16	T3-E3-Sh3-Rc2		
7	Sh2-Rc2	17	T3-E3-Sh3-Rc3		
8	T2	18	T3-E12		
9	T2-E3	19	T3-E12-E3-Sh3-Rc2		
10	T2-E3-Sh2-Rc2	20	T3-E3		

CODE	LANDUSE
4	Corn
51	Cassava
84	Pineapple
85	Mango
116	Coconut
126	Grassland
134	Shrubs, unmanaged

LAND SUITABILITY MAP FOR CACAO

LAND RESOURCES EVALUATION AND SUITABILITY ASSESSMENT OF STRATEGIC PRODUCTION AREAS

NORTH COTABATO, REGION XII

EXTENT OF SUITABILITY FOR CACAO PRODUCTION BY MUNICIPALITY

MUNICIPALITY	EXISTING CACAO (Ha)			TOTAL EXISTING AREA (Ha)	EXPANSION AREA (Ha)						CONFLICT RESOLUTION AREA (Ha)								TOTAL POTENTIAL EXPANSION AREA (Ha)
					Coconut		Shrubland, unmanaged*		Grassland, unmanaged*		Corn		Sugarcane		Pineapple		Other crops		
	S1	S2	S3		S1	S2	S1	S2	S1	S2	S1	S2	S1	S2	S1	S2	S1	S2	
ALAMADA	-	-	-	-	1,169	673	-	1,147	1,479	7,263	5,411	7,275	-	-	-	-	-	-	24417
ALEOSAN	-	-	-	-	724	798	87	511	7	640	2,229	1,246	3,156	3,685	-	-	1,036	1,168	15288
ANTIPAS	-	-	-	-	1,141	4,518	-	-	3	170	334	788	-	-	-	-	-	-	6955
ARAKAN	-	-	-	-	682	4,355	84	92	225	1,961	914	4,412	37	-	-	-	-	1	12765
BANISILAN	-	-	-	-	13	31	2	690	21	2,621	207	3,082	19	10,143	-	-	-	-	16830
CARMEN	-	-	-	-	1,405	532	270	1,208	5,304	2,239	19,987	2,812	135	162	-	-	47	1	34102
CITY OF KIDAPAWAN	-	-	-	-	16,097	3,329	-	-	-	-	2,183	299	-	-	1,349	180	-	-	23437
KABACAN	-	-	-	-	635	3	11	528	455	2,347	5,358	718	-	-	-	-	-	-	10053
LIBUNGAN	-	-	-	-	289	1,115	-	-	1,628	92	1,905	390	972	86	-	-	944	770	8191
MAGPET	-	-	-	-	4,357	1,284	-	4	55	860	921	884	-	-	-	-	1	-	8374
MAKILALA	-	4	-	4	6,155	3,237	335	59	639	-	3,049	84	-	-	4,262	101	-	-	17920
MATALAM	-	-	-	-	2,098	3,361	87	221	269	3,184	13,413	3,393	-	-	-	-	-	-	26027
MIDSAYAP	-	-	-	-	632	-	494	-	-	-	6,726	611	450	576	-	-	1,873	2,073	13436
M'LANG	-	-	-	-	5,764	41	-	-	-	-	11,117	24	-	-	2,489	-	-	-	19436
PIGKAWAYAN	-	-	-	-	4,955	158	82	65	1,484	381	1,829	108	-	-	-	218	-	-	9279
PIKIT	-	-	-	-	3,657	377	720	171	44	1,220	9,509	568	10	49	-	-	-	-	16326
PRESIDENT ROXAS	-	-	-	-	2,337	2,362	34	357	4,624	2,987	4,974	1,399	-	1	-	-	20	-	19095
TULUNAN	-	-	-	-	2,509	3	19	-	3,789	147	7,569	-	-	-	701	-	-	-	14737
TOTAL	-	4	-	4	54,621	26,177	2,223	5,053	20,027	26,121	97,636	28,094	4,779	14,703	8,802	281	4,139	4,013	296,670

Note: Delivery of cacao planting materials must be started on the onset of rainy season.
**establishment of shade trees prior to planting of cacao.*

SUITABILITY CLASSES:

Highly Suitable (S1)
Land having no significant limitation to sustained application of a given use, or only minor limitations that will not significantly reduce productivity or benefits and will not raise inputs above an acceptable level,

Moderately Suitable (S2)
Land having limitations which in aggregate are moderately severe for sustained application of a given use; the limitation will reduce productivity or benefits and increase required inputs to the extent that the overall advantage to be gained from the use, although still attractive, will be appreciably inferior to that expected on class S1 land,

Marginally Suitable (S3)
Land having limitations which in aggregate are severe for sustained application of a given use and will so reduce productivity or benefits, or increase required inputs, that this expenditure will be only marginally justified,

Not Suitable / Not Relevant
Land having limitations which may be surmountable in time but which cannot be corrected with existing knowledge at currently acceptable cost; the limitations are so severe as to preclude successful sustained use of the land in the given manner, Existing forest, shrubland greater than 18% slope, irrigated paddy rice and miscellaneous land types such as built up areas, roads, etc are considered as not relevant,

AGRONOMIC REQUIREMENT OF CACAO PRODUCTION

LAND UTILIZATION TYPE	SUITABILITY RATING	SLOPE (%)	SOIL DEPTH (cm)	SOIL TEXTURE	SOIL DRAINAGE	SOIL REACTION (pH)	INHERENT FERTILITY	FLOODING CLASS	EROSION CLASS	ROCK OUTCROPS	ELEVATION (masl)	ANNUAL RAINFALL (mm)	CLIMATIC TYPE
Cacao	S1	<8	>100	CL, SiCL, SCL, SC, SiC, C, HC	WD,MWD	5.6 -7.2	high	none-slight	none-slight	none-few	<1000	2001-4500	I, III, IV
	S2	8 - 30	50 - 100	FSL, L, SiL	SPD,PD	5.1 - 5.5 7.3 - 7.8	medium	moderate	moderate	common	1000-1500	1000-2000	I, II
	S3	>30	<50	S, LS, CSL, SL	VPD,ED	<5.0 - > 7.9	low	severe	severe	many	>1500	<1000 >4500	

SLOPE (%)
0 - 3 - level to gently sloping
3 - 8 - gently sloping to undulating
8 - 18 - undulating to rolling
18 - 30 - rolling to moderately steep
30 - 50 - steep
> 50 - very steep

SOIL DEPTH (cm)
0 - 30 - very shallow
30 - 50 - shallow
50 - 100 - moderately deep
> 100 - deep to very deep

SOIL DRAINAGE
ED - excessively drained
WD - well drained
MWD - moderately well drained
SPD - somewhat poorly drained
PD - poorly drained
VPD - very poorly drained

SURFACE IMPEDIMENT
ROCK OUTCROPS
< 10% - none - few
10 - 30% - common
> 30% - many

SOIL REACTION (pH)
< 4.5 - extremely acid
4.5 - 5.0 - very strongly acid
5.1 - 5.5 - strongly acid
5.6 - 6.0 - medium acid
6.1 - 6.5 - slightly acid
6.6 - 7.2 - neutral
7.3 - 7.8 - mildly alkaline
7.9 - 8.4 - moderately alkaline
> 8.5 - strongly alkaline

SOIL TEXTURE
Coarse
S - sand
LS - loamy sand
CSL - coarse sandy loam
SL - sandy loam
Medium
FSL - fine sandy loam
L - loam
SiL - silt loam
CL - clay loam
SiCL - silty clay loam
SCL - sandy clay loam
Fine
SC - sandy clay
SiC - silty clay
C - clay
HC - heavy clay

CLIMATE TYPE

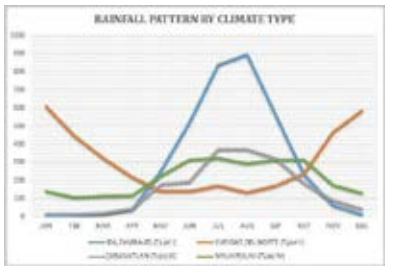
TYPE I : Two pronouced season, dry from November to April and wet during the rest of the year, Maximum rain period is from June to September

TYPE II : No dry season with a very pronounced maximum rain period from December to February, There is not a single dry month, Maximum monthly rainfall occurs during the period from March to May,

TYPE III : No very pronounced maximum rain period, with a dry season lasting only from one to three months, either during the period from December to February or from March to May, This type resembles Type I since it has a short dry season.

TYPE IV : Rainfall is more or less evenly distributed throughout the year, This type resembles Type II since it has no dry season,

North Cotabato is mostly classified as climatic Type III and partly Type IV in the Eastern part.



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LAND LIMITATIONS DESCRIPTION AND COMBINATIONS

ELEVATION
El2 - 1000m - 1500m
El3 - > 1500m

SLOPE/TOPOGRAPHY
T2 - Undulating to moderately steep
T3 - Steep to very steep

SOIL DRAINAGE
D2 - Somewhat poorly drained to poorly drained
D3 - Very poorly drained or excessively drained

SOIL TEXTURE
Tc - Coarse texture

SOIL DEPTH
Sh2 - Moderately deep (50 - 100cm)
Sh3 - Very shallow to shallow (< 50cm)

ROCK OUTCROPS
Rc2 - Common
Rc3 - Many

SOIL EROSION
E2 - Moderate erosion
E3 - Severe erosion

FLOODING
F2 - Moderate seasonal flooding
F3 - Severe seasonal flooding

CODE	LIMITATION	CODE	LIMITATION	CODE	LIMITATION	CODE	LIMITATION	CODE	LIMITATION
1	E2-Sh2-Rc2	11	F3-D2	21	T2-El2-E3-Sh2-Rc2	31	T3-El2-E3-Rc2	41	T3-El2-E3-Sh3-Rc3
2	El2	12	Sh2-Rc2	22	T2-El2-E3-Sh2-Rc3	32	T3-El2-E3-Sh3-Rc2	42	T3-El3-E3-Sh3-Rc3
3	El2-E2-Sh2-Rc3	13	T2	23	T2-El3-E3-Sh2-Rc2	33	T3-El2-E3-Sh3-Rc3		
4	El2-E3-Sh2-Rc3	14	T2-E3	24	T3	34	T3-El3-E3-Sh3-Rc2		
5	El2-Rc2	15	T2-E3-Rc3	25	T3-E3	35	T3		
6	El2-Sh2-Rc2	16	T2-E3-Sh2-Rc2	26	T3-E3-Sh2-Rc3	36	T3-E3		
7	El2-Sh2-Rc3	17	T2-E3-Sh2-Rc3	27	T3-E3-Sh3-Rc2	37	T3-E3-Sh3-Rc3		
8	El3	18	T2-El2	28	T3-E3-Sh3-Rc3	38	T3-El2		
9	El3-Sh2-Rc2	19	T2-El2-E3	29	T3-El2	39	T3-El2-E3		
10	F2-D2	20	T2-El2-E3-Rc2	30	T3-El2-E3	40	T3-El2-E3-Rc3		

CODE	LANDUSE
4	Corn
34	Diversified crops
84	Pineapple
91	Banana
105	Fruit trees, mixed
112	Sugarcane
116	Coconut
126	Grassland
134	Shrubs, unmanaged
137	Rubber (T)

LAND SUITABILITY MAP FOR CACAO

LAND RESOURCES EVALUATION AND SUITABILITY ASSESSMENT OF STRATEGIC PRODUCTION AREAS

SARANGANI, REGION XII

EXTENT OF SUITABILITY FOR CACAO PRODUCTION BY MUNICIPALITY

MUNICIPALITY	EXISTING CACAO (Ha)			TOTAL EXISTING AREA (Ha)	EXPANSION AREA (Ha)						CONFLICT RESOLUTION AREA (Ha)						TOTAL POTENTIAL EXPANSION AREA (Ha)
					Coconut		Shrubland, unmanaged*		Grassland, unmanaged*		Corn		Paddy rice, non-irrigated		Other crops		
	S1	S2	S3		S1	S2	S1	S2	S1	S2	S1	S2	S1	S2	S1	S2	
ALABEL	-	-	-	-	5,745	564	635	13	3,584	1,290	868	3	-	-	-	-	12,702
GLAN	-	-	-	-	7,445	2,498	90	33	2,421	1,094	211	32	-	-	-	-	13,824
KIAMBA	-	-	-	-	5,250	55	407	131	147	38	1,410	-	-	-	-	-	7,437
MAASIM	-	-	-	-	4,417	956	356	50	1,790	1,645	81	-	-	-	-	-	9,296
MAITUM	-	-	-	-	2,944	670	117	47	90	53	1,441	71	-	-	-	-	5,431
MALAPATAN	-	-	-	-	5,113	889	63	21	1,076	566	27	5	-	-	-	-	7,761
MALUNGON	38	-	14	52	9,327	11	1,798	40	1,793	271	7,151	599	-	-	7	-	20,996
TOTAL	38	-	14	52	40,241	5,643	3,465	336	10,900	4,956	11,189	710	-	-	7	-	77,448

Note: Delivery of cacao planting materials must be started on the onset of rainy season.
**establishment of shade trees prior to planting of cacao.*

SUITABILITY CLASSES:

Highly Suitable (S1)
Land having no significant limitation to sustained application of a given use, or only minor limitations that will not significantly reduce productivity or benefits and will not raise inputs above an acceptable level,

Marginally Suitable (S3)
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AGRONOMIC REQUIREMENT OF CACAO PRODUCTION

LAND UTILIZATION TYPE	SUITABILITY RATING	SLOPE (%)	SOIL DEPTH (cm)	SOIL TEXTURE	SOIL DRAINAGE	SOIL REACTION (pH)	INHERENT FERTILITY	FLOODING CLASS	EROSION CLASS	ROCK OUTCROPS	ELEVATION (masl)	ANNUAL RAINFALL (mm)	CLIMATIC TYPE
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	S2	8 - 30	50 - 100	FSL, L, SiL	SPD,PD	5.1 - 5.5 7,3 - 7,8	medium	moderate	moderate	common	1000-1500	1000-2000	I, II
	S3	>30	<50	S, LS, CSL, SL	VPD,ED	<5,0 -> 7,9	low	severe	severe	many	>1500	<1000 >4500	

SLOPE (%)
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30 - 50 - steep
> 50 - very steep

SOIL DEPTH (cm)
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SOIL DRAINAGE
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SURFACE IMPEDIMENT
ROCK OUTCROPS
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6,6 - 7,2 - neutral
7,3 - 7,8 - mildly alkaline
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S - sand
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CLIMATE TYPE

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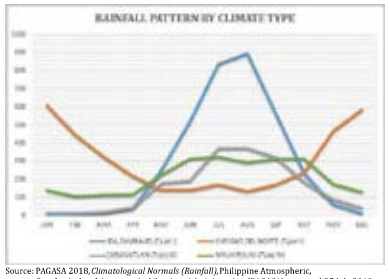
TYPE IV : Rainfall is more or less evenly distributed throughout the year, This type resembles Type II since it has no dry season.

Sarangani is classified as climatic Type IV.



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LAND LIMITATIONS DESCRIPTION AND COMBINATIONS

ELEVATION
El2 - 1000m - 1500m
El3 - > 1500m

SLOPE/TOPOGRAPHY
T2 - Undulating to moderately steep
T3 - Steep to very steep

SOIL DRAINAGE
D2 - Somewhat poorly drained to poorly drained
D3 - Very poorly drained or excessively drained

SOIL TEXTURE
Tc - Coarse texture

SOIL DEPTH
Sh2 - Moderately deep (50 - 100cm)
Sh3 - Very shallow to shallow (< 50cm)

ROCK OUTCROPS
Rc2 - Common
Rc3 - Many

SOIL EROSION
E2 - Moderate erosion
E3 - Severe erosion

FLOODING
F2 - Moderate seasonal flooding
F3 - Severe seasonal flooding

CODE	LIMITATION	CODE	LIMITATION	CODE	LIMITATION	CODE	LIMITATION	CODE	LIMITATION	CODE	LIMITATION
1	E2-Sh2-Rc2	11	Sh2-Rc2	21	T2-El2-E3-Rc3	31	T3-E3-Sh2-Rc3	41	T3-El3-E3-Sh3-Rc2	51	T3-El3-E3-Sh3-Rc3
2	El2	12	T2	22	T2-El2-E3-Sh2-Rc2	32	T3-E3-Sh3-Rc2	42	T3-F2-D2	52	T3-El3
3	El2-E2-Sh2-Rc3	13	T2-E3	23	T2-El2-E3-Sh2-Rc3	33	T3-E3-Sh3-Rc3	43	T3	53	Tc
4	El2-E3-Rc3	14	T2-E3-Rc2	24	T2-El3-E3-Rc3	34	T3-El2	44	T3-E3		
5	El2-E3-Sh2-Rc3	15	T2-E3-Rc3	25	T2-El3-E3-Sh2-Rc2	35	T3-El2-E3	45	T3-E3-Rc3		
6	El2-Rc2	16	T2-E3-Sh2-Rc2	26	T2-F2-D2	36	T3-El2-E3-Rc2	46	T3-E3-Sh3-Rc3		
7	El2-Sh2-Rc2	17	T2-E3-Sh2-Rc3	27	T2-F3-D2	37	T3-El2-E3-Sh2-Rc3	47	T3-El2		
8	E13-Sh2-Rc2	18	T2-El2	28	T3	38	T3-El2-E3-Sh3-Rc2	48	T3-El2-E3		
9	F2-D2	19	T2-El2-E3	29	T3-E3	39	T3-El2-E3-Sh3-Rc3	49	T3-El2-E3-Rc3		
10	F3-D2	20	T2-El2-E3-Rc2	30	T3-E3-Rc2	40	T3-El3-E3-Sh2-Rc3	50	T3-El2-E3-Sh3-Rc3		

CODE	LANDUSE
4	Corn
81	Coffee
82	Cacao
85	Mango
91	Banana
105	Fruit trees, mixed
116	Coconut
126	Grassland
134	Shrubs, unmanaged

LAND SUITABILITY MAP FOR CACAO

LAND RESOURCES EVALUATION AND SUITABILITY ASSESSMENT OF STRATEGIC PRODUCTION AREAS

SOUTH COTABATO, REGION XII

EXTENT OF SUITABILITY FOR CACAO PRODUCTION BY MUNICIPALITY

MUNICIPALITY	EXISTING CACAO (Ha)			TOTAL EXISTING AREA (Ha)	EXPANSION AREA (Ha)						CONFLICT AREA (Ha)								TOTAL POTENTIAL EXPANSION AREA (Ha)
					Coconut		Shrubland, unmanaged*		Grassland, unmanaged*		Corn		Pineapple		Banana		Other crops		
	S1	S2	S3		S1	S2	S1	S2	S1	S2	S1	S2	S1	S2	S1	S2	S1	S2	
BANGA	-	-	-	-	623	93	-	-	468	1,246	9,697	395	-	-	5	-	-	-	12,526
CITY OF KORONADAL	-	-	-	-	2,546	70	73	67	692	764	6,413	192	-	-	-	-	-	-	10,817
LAKE SEBU	-	-	-	-	6	516	20	154	755	2,525	1,155	2,827	-	-	-	1	-	-	7,961
NORALA	-	-	-	-	387	128	-	-	380	338	2,071	34	-	-	-	-	-	-	3,329
POLOMOLOK	-	-	-	-	843	769	2	389	11	1,030	8,824	2,407	3,519	4,056	-	-	-	-	21,850
SANTO NIÑO	-	-	-	-	50	-	-	-	19	-	1,875	-	-	-	-	-	-	-	1,944
SURALLAH	-	-	-	-	819	7	99	-	642	219	11,641	153	-	-	-	-	4	-	13,584
TAMPAKAN	-	-	-	-	1,884	-	-	119	384	769	2,990	-	2	-	-	-	-	-	6,148
TANTANGAN	-	-	-	-	588	23	11	8	2,153	726	3,691	85	2	-	4	-	-	-	7,291
T'BOLI	-	-	-	-	93	51	-	158	444	4,594	2,436	2,190	-	-	1	1	-	-	9,968
TUPI	-	-	-	-	3,758	369	-	39	350	1,641	1,931	1,726	4,061	914	-	-	-	-	14,790
TOTAL	-	-	-	-	11,597	2,017	205	935	6,298	13,852	52,724	10,009	7,585	4,971	9	3	4	-	**110,208**

Note: Delivery of cacao planting materials must be started on the onset of rainy season.
**establishment of shade trees prior to planting of cacao.*

SUITABILITY CLASSES:

Highly Suitable (S1)
Land having no significant limitation to sustained application of a given use, or only minor limitations that will not significantly reduce productivity or benefits and will not raise inputs above an acceptable level.

Moderately Suitable (S2)
Land having limitation which in aggregate are moderately severe for sustained application of a given use; the limitation will reduce productivity or benefits and increase required inputs to the extent that the overall advantage to be gained from the use, although still attractive, will be appreciably inferior to that expected on class S1 land.

Marginally Suitable (S3)
Land having limitations which in aggregate are severe for sustained application of a given use and will so reduce productivity or benefits, or increase required inputs, that this expenditure will be only marginally justified.

Not Suitable / Not Relevant
Land having limitations which may be surmountable in time but which cannot be corrected with existing knowledge at currently acceptable cost; the limitations are so severe as to preclude successful sustained use of the land in the given manner. Existing forest, shrubland greater than 18% slope, irrigated paddy rice and miscellaneous land types such as built up areas, roads, etc are considered as not relevant.

AGRONOMIC REQUIREMENT OF CACAO PRODUCTION

LAND UTILIZATION TYPE	SUITABILITY RATING	SLOPE (%)	SOIL DEPTH (cm)	SOIL TEXTURE	SOIL DRAINAGE	SOIL REACTION (pH)	INHERENT FERTILITY	FLOODING CLASS	EROSION CLASS	ROCK OUTCROPS	ELEVATION (masl)	ANNUAL RAINFALL (mm)	CLIMATIC TYPE
Cacao	S1	<8	>100	CL, SiCL, SCL, SC, SiC, C, HC	WD,MWD	5.6 -7.2	high	none-slight	none-slight	none-few	<1000	2001-4500	I, III, IV
	S2	8 - 30	50 - 100	FSL, L, SiL	SPD,PD	5.1 - 5.5 7.3 - 7.8	medium	moderate	moderate	common	1000-1500	1000-2000	I, II
	S3	>30	<50	S, LS, CSL, SL	VPD,ED	<5.0 - > 7.9	low	severe	severe	many	>1500	<1000 >4500	

SLOPE (%)
0 - 3 - level to gently sloping
3 - 8 - gently sloping to undulating
8 - 18 - undulating to rolling
18 - 30 - rolling to moderately steep
30 - 50 - steep
> 50 - very steep

SOIL DEPTH (cm)
0 - 30 - very shallow
30 - 50 - shallow
50 - 100 - moderately deep
> 100 - deep to very deep

SOIL DRAINAGE
ED - excessively drained
WD - well drained
MWD - moderately well drained
SPD - somewhat poorly drained
PD - poorly drained
VPD - very poorly drained

SURFACE IMPEDIMENT
ROCK OUTCROPS
< 10% - none - few
10 - 30% - common
> 30% - many

SOIL REACTION (pH)
< 4.5 - extremely acid
4.5 - 5.0 - very strongly acid
5.1 - 5.5 - strongly acid
5.6 - 6.0 - medium acid
6.1 - 6.5 - slightly acid
6.6 - 7.2 - neutral
7.3 - 7.8 - mildly alkaline
7.9 - 8.4 - moderately alkaline
> 8.5 - strongly alkaline

SOIL TEXTURE
Coarse
S - sand
LS - loamy sand
CSL - coarse sandy loam
SL - sandy loam
Medium
FSL - fine sandy loam
L - loam
SiL - silt loam
Cl - clay loam
SiCL - silty clay loam
SCL - sandy clay loam
Fine
SC - sandy clay
SiC - silty clay
C - clay
HC - heavy clay

CLIMATE TYPE

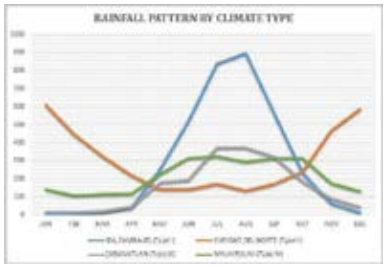
TYPE I : Two pronouced season, dry from November to April and wet during the rest of the year. Maximum rain period is from June to September

TYPE II : No dry season with a very pronounced maximum rain period from December to February. There is not a single dry month. Maximum monthly rainfall occurs during the period from March to May.

TYPE III : No very pronounced maximum rain period, with a dry season lasting only from one to three months, either during the period from December to February or from March to May. This type resembles Type I since it has a short dry season.

TYPE IV : Rainfall is more or less evenly distributed throughout the year. This type resembles Type II since it has no dry season.

Small part in the Northern side of South Cotabato is classified as climatic Type III and in the Southern side is Type IV.



Source: PAGASA 2018, *Climatological Normals (Rainfall)*, Philippine Atmospheric, Geophysical and Astronomical Services Administration (PAGASA), accessed 27 July 2018, <https://www1.pagasa.dost.gov.ph/index.php/climate/climatological-normals>.

LAND LIMITATIONS DESCRIPTION AND COMBINATIONS

ELEVATION
El2 - 1000m - 1500m
El3 - > 1500m

SLOPE/TOPOGRAPHY
T2 - Undulating to moderately steep
T3 - Steep to very steep

SOIL DRAINAGE
D2 - Somewhat poorly drained to poorly drained
D3 - Very poorly drained or excessively drained

SOIL TEXTURE
Tc - Coarse texture

SOIL DEPTH
Sh2 - Moderately deep (50 - 100cm)
Sh3 - Very shallow to shallow (< 50cm)

ROCK OUTCROPS
Rc2 - Common
Rc3 - Many

SOIL EROSION
E2 - Moderate erosion
E3 - Severe erosion

FLOODING
F2 - Moderate seasonal flooding
F3 - Severe seasonal flooding

CODE	LIMITATION	CODE	LIMITATION	CODE	LIMITATION	CODE	LIMITATION	CODE	LIMITATION
1	E2-Sh2-Rc2	11	T2	21	T2-El2-F2-D2	31	T3-El2-E3-Rc2	41	T3-El2
2	El2	12	T2-E3	22	T2-El3-E3	32	T3-El2-E3-Sh3-Rc2	42	T3-El2-E3
3	El2-E2-Sh2-Rc3	13	T2-E3-Rc2	23	T2-El3-E3-Sh2-Rc2	33	T3-El2-E3-Sh3-Rc3	43	T3-El2-E3-Rc3
4	El2-E3-Sh2-Rc3	14	T2-E3-Sh2-Rc2	24	T3	34	T3-El2-F2-D2	44	T3-El2-E3-Sh3-Rc3
5	El2-F2-D2	15	T2-E3-Sh2-Rc3	25	T3-E3	35	T3-El3-E3	45	T3-El3-E3
6	El2-Rc2	16	T2-El2	26	T3-E3-Rc2	36	T3-El3-E3-Sh3-Rc2	46	T3-El3-E3-Sh3-Rc3
7	El2-Sh2-Rc2	17	T2-El2-E3	27	T3-E3-Sh3-Rc2	37	T3		
8	El3-Sh2-Rc2	18	T2-El2-E3-Rc2	28	T3-E3-Sh3-Rc3	38	T3-E3		
9	F2-D2	19	T2-El2-E3-Sh2-Rc2	29	T3-El2	39	T3-E3-Rc3		
10	Sh2-Rc2	20	T2-El2-E3-Sh2-Rc3	30	T3-El2-E3	40	T3-E3-Sh3-Rc3		

CODE	LANDUSE
4	Corn
81	Coffee
82	Cacao
85	Mango
91	Banana
105	Fruit trees, mixed
116	Coconut
126	Grassland
134	Shrubs, unmanaged

LAND SUITABILITY MAP FOR CACAO

LAND RESOURCES EVALUATION AND SUITABILITY ASSESSMENT OF STRATEGIC PRODUCTION AREAS

SULTAN KUDARAT, REGION XII

EXTENT OF SUITABILITY FOR CACAO PRODUCTION BY MUNICIPALITY

MUNICIPALITY	EXISTING CACAO (Ha)			TOTAL EXISTING AREA (Ha)	EXPANSION AREA (Ha)						CONFLICT AREA (Ha)						TOTAL POTENTIAL EXPANSION AREA (Ha)
					Coconut		Shrubland, unmanaged*		Grassland, unmanaged*		Corn		Oil palm		Other crops		
	S1	S2	S3		S1	S2	S1	S2	S1	S2	S1	S2	S1	S2	S1	S2	
BAGUMBAYAN	-	-	-	-	2,527	522	58	-	342	5,303	3,623	10,892	77	31	-	-	23,374
CITY OF TACURONG	-	-	-	-	162	-	4	-	2,904	59	3,175	-	1,809	-	9	-	8,122
COLUMBIO	-	-	-	-	41	-	14	8	4,312	237	1,942	-	-	-	-	-	6,555
ESPERANZA	-	-	-	-	692	603	-	31	28	100	3,891	1,567	-	-	-	-	6,913
ISULAN	-	-	-	-	461	288	28	179	-	1,317	4,999	1,319	1,556	146	-	-	10,285
KALAMANSIG	-	-	-	-	2,516	-	371	10	173	-	77	-	-	-	-	-	3,147
LAMBAYONG	-	-	-	-	152	-	-	-	-	-	4,262	11	-	-	-	-	4,425
LEBAK	20	-	-	20	4,456	2,035	87	109	210	92	520	2,258	-	-	1	-	9,769
LUTAYAN	-	-	-	-	920	-	331	-	638	-	3,857	-	-	-	-	-	5,746
PALIMBANG	-	-	-	-	6,589	871	6	747	-	1,447	1,274	1,656	-	-	-	-	12,593
PRESIDENT QUIRINO	-	-	-	-	1,277	-	-	-	-	-	3,590	-	-	-	-	-	4,868
SEN. NINOY AQUINO	-	-	-	-	-	-	-	-	-	3,208	-	12,607	-	-	-	-	15,815
TOTAL	20	-	-	**20**	19,795	4,310	899	1,084	8,607	11,764	31,212	30,312	3,442	177	10	-	**111,611**

Note: Delivery of cacao planting materials must be started on the onset of rainy season.
**establishment of shade trees prior to planting of cacao.*

SUITABILITY CLASSES:

Highly Suitable (S1)
Land having no significant limitation to sustained application of a given use, or only minor limitations that will not significantly reduce productivity or benefits and will not raise inputs above an acceptable level.

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AGRONOMIC REQUIREMENT OF CACAO PRODUCTION

LAND UTILIZATION TYPE	SUITABILITY RATING	SLOPE (%)	SOIL DEPTH (cm)	SOIL TEXTURE	SOIL DRAINAGE	SOIL REACTION (pH)	INHERENT FERTILITY	FLOODING CLASS	EROSION CLASS	ROCK OUTCROPS	ELEVATION (masl)	ANNUAL RAINFALL (mm)	CLIMATIC TYPE
Cacao	S1	<8	>100	CL, SiCL, SCL, SC, SiC, C, HC	WD,MWD	5,6 -7,2	high	none-slight	none-slight	none-few	<1000	2001-4500	I, III, IV
	S2	8 - 30	50 - 100	FSL, L, SiL	SPD,PD	5,1 - 5,5 7,3 - 7,8	medium	moderate	moderate	common	1000-1500	1000-2000	I, II
	S3	>30	<50	S, LS, CSL, SL	VPD,ED	<5,0 - > 7,9	low	severe	severe	many	>1500	<1000 >4500	

SLOPE (%)
0 - 3 - level to gently sloping
3 - 8 - gently sloping to undulating
8 - 18 - undulating to rolling
18 - 30 - rolling to moderately steep
30 - 50 - steep
> 50 - very steep

SOIL DEPTH (cm)
0 - 30 - very shallow
30 - 50 - shallow
50 - 100 - moderately deep
> 100 - deep to very deep

SOIL DRAINAGE
ED - excessively drained
WD - well drained
MWD - moderately well drained
SPD - somewhat poorly drained
PD - poorly drained
VPD - very poorly drained

SURFACE IMPEDIMENT
ROCK OUTCROPS
< 10% - none - few
10 - 30% - common
> 30% - many

SOIL REACTION (pH)
< 4,5 - extremely acid
4,5 - 5,0 - very strongly acid
5,1 - 5,5 - strongly acid
5,6 - 6,0 - medium acid
6,1 - 6,5 - slightly acid
6,6 - 7,2 - neutral
7,3 - 7,8 - mildly alkaline
7,9 - 8,4 - moderately alkaline
> 8,5 - strongly alkaline

SOIL TEXTURE
Coarse
S - sand
LS - loamy sand
CSL - coarse sandy loam
SL - sandy loam
Medium
FSL - fine sandy loam
L - loam
SiL - silt loam
CL - clay loam
SiCL - silty clay loam
SCL - sandy clay loam
Fine
SC - sandy clay
SiC - silty clay
C - clay
HC - heavy clay

CLIMATE TYPE

TYPE I : Two pronouced season, dry from November to April and wet during the rest of the year, Maximum rain period is from June to September

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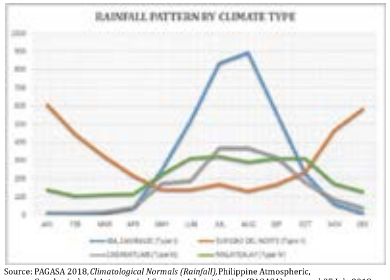
TYPE IV : Rainfall is more or less evenly distributed throughout the year, This type resembles Type II since it has no dry season.

The Eastern part of Sultan Kudarat is classified as climatic Type III and the Southern part lies to climatic Type IV.



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LAND LIMITATIONS DESCRIPTION AND COMBINATIONS

ELEVATION
EI2 - 1000m - 1500m
EI3 - > 1500m

SOIL DRAINAGE
D2 - Somewhat poorly drained to poorly drained
D3 - Very poorly drained or excessively drained

SOIL DEPTH
Sh2 - Moderately deep (50 - 100cm)
Sh3 - Very shallow to shallow (< 50cm)

SOIL EROSION
E2 - Moderate erosion
E3 - Severe erosion

SLOPE/TOPOGRAPHY
T2 - Undulating to moderately steep
T3 - Steep to very steep

SOIL TEXTURE
Tc - Coarse texture

ROCK OUTCROPS
Rc2 - Common
Rc3 - Many

FLOODING
F2 - Moderate seasonal flooding
F3 - Severe seasonal flooding

CODE	LIMITATION	CODE	LIMITATION	CODE	LIMITATION	CODE	LIMITATION	CODE	LIMITATION	CODE	LIMITATION
1	E2-Sh2-Rc2	*11*	F2-D2	*21*	T2-EI2-E3	*31*	T3-E3	*41*	T3-EI3-E3-Sh3-Rc2	*51*	T3-EI2-E3-Sh3-Rc3
2	EI2	*12*	F3-D2	*22*	T2-EI2-E3-Rc2	*32*	T3-E3-Rc2	*42*	T3-EI3-E3-Sh3-Rc3	*52*	T3-EI3-E3
3	EI2-E2-Sh2-Rc3	*13*	Sh2	*23*	T2-EI2-E3-Sh2-Rc2	*33*	T3-E3-Sh3-Rc2	*43*	T3-F3-D2	*53*	T3-EI3-E3-Sh3-Rc3
4	EI2-E3-Sh2-Rc3	*14*	Sh2-Rc2	*24*	T2-EI2-E3-Sh2-Rc3	*34*	T3-E3-Sh3-Rc3	*44*	T3	*54*	T3-EI3
5	EI2-Rc2	*15*	T2	*25*	T2-EI3-E3	*35*	T3-EI2	*45*	T3-E3	*55*	Tc
6	EI2-Sh2-Rc2	*16*	T2-E3	*26*	T2-EI3-E3-Sh2-Rc2	*36*	T3-EI2-E3	*46*	T3-E3-Rc3		
7	EI2-Sh2-Rc3	*17*	T2-E3-Rc2	*27*	T2-EI3-E3-Sh2-Rc3	*37*	T3-EI2-E3-Rc2	*47*	T3-E3-Sh3-Rc3		
8	EI3	*18*	T2-E3-Sh2-Rc2	*28*	T2-F2-D2	*38*	T3-EI2-E3-Sh3-Rc2	*48*	T3-EI2		
9	EI3-E3-Sh2-Rc3	*19*	T2-E3-Sh2-Rc3	*29*	T2-F3-D2	*39*	T3-EI2-E3-Sh3-Rc3	*49*	T3-EI2-E3		
10	EI3-Sh2-Rc2	*20*	T2-EI2	*30*	T3	*40*	T3-EI3-E3	*50*	T3-EI2-E3-Rc3		

CODE	LANDUSE
4	Corn
81	Coffee
82	Cacao
91	Banana
116	Coconut
119	Oil palm
126	Grassland
134	Shrubs, unmanaged

LAND SUITABILITY MAP FOR CACAO

LAND RESOURCES EVALUATION AND SUITABILITY ASSESSMENT OF STRATEGIC PRODUCTION AREAS

AGUSAN DEL NORTE, REGION XIII

EXTENT OF SUITABILITY FOR CACAO PRODUCTION BY MUNICIPALITY

MUNICIPALITY	EXISTING CACAO (Ha)			TOTAL EXISTING AREA (Ha)	EXPANSION AREA (Ha)						CONFLICT RESOLUTION AREA (Ha)						TOTAL POTENTIAL EXPANSION AREA (Ha)
					Coconut		Shrubland, unmanaged*		Grassland, unmanaged*		Corn		Paddy rice, non-irrigated		Other crops		
	S1	S2	S3		S1	S2	S1	S2	S1	S2	S1	S2	S1	S2	S1	S2	
BUENAVISTA	1	-	-	1	7,898	103	434	130	892	80	680	-	-	-	-	-	10,216
BUTUAN CITY	-	-	-	-	20,582	2	249	4	200	-	7,145	-	-	-	-	-	28,181
CARMEN	-	-	-	-	1,839	26	-	-	362	1	141	-	-	-	-	-	2,370
CITY OF CABADBARAN	-	-	-	-	3,703	-	-	-	199	-	2,974	-	-	-	-	-	6,876
JABONGA	-	-	1	1	1,031	221	-	-	109	16	820	-	-	-	-	-	2,197
KITCHARAO	1	-	-	1	1,038	29	15	1	24	6	307	-	-	-	-	-	1,420
LAS NIEVES	-	1	-	1	6,345	365	450	-	319	-	1,381	7	-	-	-	-	8,868
MAGALLANES	-	-	1	1	815	-	-	-	-	-	183	-	-	-	-	-	997
NASIPIT	-	-	-	-	1,175	23	-	-	616	29	420	-	-	-	-	-	2,262
REMEDIOS T. ROMUALDEZ	1	-	-	1	874	-	-	-	-	-	543	-	-	-	-	-	1,417
SANTIAGO	2	-	-	2	1,417	-	-	-	159	-	460	-	-	-	-	-	2,036
TUBAY	1	-	-	1	1,996	338	-	-	13	164	445	-	-	-	-	-	2,955
TOTAL	6	1	2	8	48,714	1,107	1,148	134	2,893	296	15,498	7	-	-	-	-	**69,795**

Note: Delivery of cacao planting materials must be started on the onset of rainy season.
**establishment of shade trees prior to planting of cacao.*

SUITABILITY CLASSES:

Highly Suitable (S1)
Land having no significant limitation to sustained application of a given use, or only minor limitations that will not significantly reduce productivity or benefits and will not raise inputs above an acceptable level.

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	S2	8 - 30	50 - 100	FSL, L, SiL	SPD,PD	5.1 - 5.5 7,3 - 7,8	medium	moderate	moderate	common	1000-1500	1000-2000	I, II
	S3	>30	<50	S, LS, CSL, SL	VPD,ED	<5.0 - > 7.9	low	severe	severe	many	>1500	<1000 >4500	

SLOPE (%)
0 - 3 - level to gently sloping
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8 - 18 - undulating to rolling
18 - 30 - rolling to moderately steep
30 - 50 - steep
> 50 - very steep

SOIL DEPTH (cm)
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SOIL DRAINAGE
ED - excessively drained
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SURFACE IMPEDIMENT
ROCK OUTCROPS
< 10% - none - few
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> 30% - many

SOIL REACTION (pH)
< 4,5 - extremely acid
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6,6 - 7,2 - neutral
7,3 - 7,8 - mildly alkaline
7,9 - 8,4 - moderately alkaline
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SOIL TEXTURE
Coarse
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LS - loamy sand
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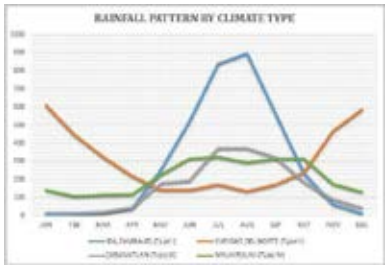
TYPE III : No very pronounced maximum rain period, with a dry season lasting only from one to three months, either during the period from December to February or from March to May. This type resembles Type I since it has a short dry season.

TYPE IV : Rainfall is more or less evenly distributed throughout the year. This type resembles Type II since it has no dry season.

Western part of Agusan Del Norte is classified as climatic Type IV and North Eastern part is climatic Type II.



Source: PAGASA 2018, *Climatological Normals (Rainfall)*, Philippine Atmospheric, Geophysical and Astronomical Services Administration (PAGASA), accessed 27 July 2018, <https://www1.pagasa.dost.gov.ph/index.php/climate/climatological-normals>.

LAND LIMITATIONS DESCRIPTION AND COMBINATIONS

ELEVATION
El2 - 1000m - 1500m
El3 - > 1500m

SLOPE/TOPOGRAPHY
T2 - Undulating to moderately steep
T3 - Steep to very steep

SOIL DRAINAGE
D2 - Somewhat poorly drained to poorly drained
D3 - Very poorly drained or excessively drained

SOIL TEXTURE
Tc - Coarse texture

SOIL DEPTH
Sh2 - Moderately deep (50 - 100cm)
Sh3 - Very shallow to shallow (< 50cm)

ROCK OUTCROPS
Rc2 - Common
Rc3 - Many

SOIL EROSION
E2 - Moderate erosion
E3 - Severe erosion

FLOODING
F2 - Moderate seasonal flooding
F3 - Severe seasonal flooding

CODE	LIMITATION	CODE	LIMITATION	CODE	LIMITATION	CODE	LIMITATION	CODE	LIMITATION	CODE	LIMITATION
1	E2	11	F2-D2	21	T2-El2	31	T2-F3-D2	41	T3-El2-E3-Sh3-Rc2	51	T3-El2-E3-Rc3
2	E2-Sh2-Rc2	12	F2-Tc	22	T2-El2-E3	32	T3	42	T3-El2-E3-Sh3-Rc3	52	T3-El2-E3-Sh3-Rc3
3	El2	13	F3-D2	23	T2-El2-E3-Rc2	33	T3-E3	43	T3-El3-E3-Sh2-Rc3	53	T3-El3
4	El2-E2-Rc3	14	Sh2	24	T2-El2-E3-Rc3	34	T3-E3-Sh2-Rc3	44	T3-El3-E3-Sh3-Rc2	54	T3-El3-E3-Sh3-Rc3
5	El2-E3-Rc3	15	Sh2-Rc2	25	T2-El2-E3-Sh2-Rc2	35	T3-E3-Sh3-Rc2	45	T3-F3-D2	55	T3-El3
6	El2-E3-Sh2-Rc3	16	T2	26	T2-El2-E3-Sh2-Rc3	36	T3-E3-Sh3-Rc3	46	T3		
7	El2-Rc2	17	T2-E3	27	T2-El3-E3-Rc2	37	T3-El2	47	T3-E3		
8	El2-Sh2-Rc2	18	T2-E3-Rc3	28	T2-El3-E3-Rc3	38	T3-El2-E3	48	T3-E3-Sh3-Rc3		
9	El3-E3-Rc3	19	T2-E3-Sh2-Rc2	29	T2-El3-E3-Sh2-Rc2	39	T3-El2-E3-Rc2	49	T3-El2		
10	El3-Sh2-Rc2	20	T2-E3-Sh2-Rc3	30	T2-F2-D2	40	T3-El2-E3-Sh2-Rc3	50	T3-El2-E3		

CODE	LANDUSE
4	Corn
81	Coffee
82	Cacao
116	Coconut
126	Grassland
130	Bare areas, unmanaged
134	Shrubs, unmanaged

LAND SUITABILITY MAP FOR CACAO

LAND RESOURCES EVALUATION AND SUITABILITY ASSESSMENT OF STRATEGIC PRODUCTION AREAS

AGUSAN DEL SUR, REGION XIII

EXTENT OF SUITABILITY FOR CACAO PRODUCTION BY MUNICIPALITY

MUNICIPALITY	EXISTING CACAO (Ha)			TOTAL EXISTING AREA (Ha)	EXPANSION AREA (Ha)						CONFLICT RESOLUTION AREA (Ha)						TOTAL POTENTIAL EXPANSION AREA (Ha)
					Coconut		Shrubland, unmanaged*		Grassland, unmanaged*		Oil Palm		Corn		Other crops		
	S1	S2	S3		S1	S2	S1	S2	S1	S2	S1	S2	S1	S2	S1	S2	
BUNAWAN	104	4	-	108	5,953	225	721	-	2,645	89	180	-	-	-	534	34	10,380
CITY OF BAYUGAN	93	79	-	172	2,664	12	1,484	2	5,606	867	-	-	-	-	278	-	10,913
ESPERANZA	336	-	-	336	1,573	428	3,942	112	10,084	63	-	-	-	-	114	11	16,327
LA PAZ	168	10	-	178		-	7,113	128	4,096	228	-	-	-	-	102	-	11,667
LORETO	31	-	-	31	484	-	9,478	100	7,747	15	-	-	-	-	178	-	18,012
PROSPERIDAD	3	-	-	3	1,967	252	295	97	10,765	1,500	-	-	-	-	920	6	15,802
ROSARIO	-	-	-	-	3,900	75	1,637	21	2,200	4	1,598	-	-	-	702	-	10,137
SAN FRANCISCO	2	-	-	2	2,784	18	550	248	2,899	413	3,536	-	-	-	831	53	11,333
SAN LUIS	-	-	-	-	1,493	-	15,727	420	8,235	58	-	-	-	-	427	-	26,359
SANTA JOSEFA	-	-	-	-	1,172	7	1,644	12	51	-	2,687	-	-	-	75	-	5,649
SIBAGAT	44	22	-	65	321	-	3,689	419	3,152	1,268	-	-	-	-	66	-	8,914
TALACOGON	29	-	-	29	3,448	-	8,335	3	2,323	8	60	-	-	-	500	2	14,679
TRENTO	1	1	-	2	15,770	294	2,744	-	521	-	467	-	-	-	20	-	19,817
VERUELA	121	1	-	122	4,688	-	10,005	106	198	-	516	-	-	-	107	-	15,620
TOTAL	932	117	-	**1,049**	46,218	1,311	67,365	1,675	60,523	4,513	9,044	-	-	-	4,854	106	**195,609**

Note: Delivery of cacao planting materials must be started on the onset of rainy season.
**establishment of shade trees prior to planting of cacao.*

SUITABILITY CLASSES:

Highly Suitable (S1)
Land having no significant limitation to sustained application of a given use, or only minor limitations that will not significantly reduce productivity or benefits and will not raise inputs above an acceptable level.

Marginally Suitable (S3)
Land having limitations which in aggregate are severe for sustained application of a given use and will so reduce productivity or benefits, or increase required inputs, that this expenditure will be only marginally justified.

Moderately Suitable (S2)
Land having limitation which in aggregate are moderately severe for sustained application of a given use; the limitation will reduce productivity or benefits and increase required inputs to the extent that the overall advantage to be gained from the use, although still attractive, will be appreciably inferior to that expected on class S1 land.

Not Suitable / Not Relevant
Land having limitations which may be surmountable in time but which cannot be corrected with existing knowledge at currently acceptable cost; the limitations are so severe as to preclude successful sustained use of the land in the given manner. Existing forest, shrubland greater than 18% slope, irrigated paddy rice and miscellaneous land types such as built up areas, roads, etc are considered as not relevant.

AGRONOMIC REQUIREMENT OF CACAO PRODUCTION

LAND UTILIZATION TYPE	SUITABILITY RATING	SLOPE (%)	SOIL DEPTH (cm)	SOIL TEXTURE	SOIL DRAINAGE	SOIL REACTION (pH)	INHERENT FERTILITY	FLOODING CLASS	EROSION CLASS	ROCK OUTCROPS	ELEVATION (masl)	ANNUAL RAINFALL (mm)	CLIMATIC TYPE
Cacao	S1	<8	>100	CL, SiCL, SCL, SC, SiC, C, HC	WD,MWD	5.6 -7.2	high	none-slight	none-slight	none-few	<1000	2001-4500	I, III, IV
	S2	8 - 30	50 - 100	FSL, L, SiL	SPD,PD	5.1 - 5.5 7.3 - 7.8	medium	moderate	moderate	common	1000-1500	1000-2000	I, II
	S3	>30	<50	S, LS, CSL, SL	VPD,ED	<5.0 - > 7.9	low	severe	severe	many	>1500	<1000 >4500	

SLOPE (%)
0 - 3 - level to gently sloping
3 - 8 - gently sloping to undulating
8 - 18 - undulating to rolling
18 - 30 - rolling to moderately steep
30 - 50 - steep
> 50 - very steep

SOIL DEPTH (cm)
0 - 30 - very shallow
30 - 50 - shallow
50 - 100 - moderately deep
> 100 - deep to very deep

SOIL DRAINAGE
ED - excessively drained
WD - well drained
MWD - moderately well drained
SPD - somewhat poorly drained
PD - poorly drained
VPD - very poorly drained

SURFACE IMPEDIMENT
ROCK OUTCROPS
< 10% - none - few
10 - 30% - common
> 30% - many

SOIL REACTION (pH)
< 4.5 - extremely acid
4.5 - 5.0 - very strongly acid
5.1 - 5.5 - strongly acid
5.6 - 6.0 - medium acid
6.1 - 6.5 - slightly acid
6.6 - 7.2 - neutral
7.3 - 7.8 - mildly alkaline
7.9 - 8.4 - moderately alkaline
> 8.5 - strongly alkaline

SOIL TEXTURE
Coarse
S - sand
LS - loamy sand
CSL - coarse sandy loam
SL - sandy loam
Medium
FSL - fine sandy loam
L - loam
SiL - silt loam
CL - clay loam
SiCL - silty clay loam
SCL - sandy clay loam
Fine
SC - sandy clay
SiC - silty clay
C - clay
HC - heavy clay

CLIMATE TYPE

TYPE I : Two pronouced season, dry from November to April and wet during the rest of the year. Maximum rain period is from June to September

TYPE II : No dry season with a very pronounced maximum rain period from December to February. There is not a single dry month. Maximum monthly rainfall occurs during the period from March to May.

TYPE III : No very pronounced maximum rain period, with a dry season lasting only from one to three months, either during the period from December to February or from March to May. This type resembles Type I since it has a short dry season.

TYPE IV : Rainfall is more or less evenly distributed throughout the year. This type resembles Type II since it has no dry season.

Northeastern part of Agusan Del Sur is classified as climatic Type II while the rest, specifically, the southwestern is climatic Type IV.

LAND LIMITATIONS DESCRIPTION AND COMBINATIONS

ELEVATION
El2 - 1000m - 1500m
El3 - > 1500m

SLOPE/TOPOGRAPHY
T2 - Undulating to moderately steep
T3 - Steep to very steep

SOIL DRAINAGE
D2 - Somewhat poorly drained to poorly drained
D3 - Very poorly drained or excessively drained

SOIL TEXTURE
Tc - Coarse texture

SOIL DEPTH
Sh2 - Moderately deep (50 - 100cm)
Sh3 - Very shallow to shallow (< 50cm)

ROCK OUTCROPS
Rc2 - Common
Rc3 - Many

SOIL EROSION
E2 - Moderate erosion
E3 - Severe erosion

FLOODING
F2 - Moderate seasonal flooding
F3 - Severe seasonal flooding

CODE	LIMITATION	CODE	LIMITATION	CODE	LIMITATION	CODE	LIMITATION	CODE	LIMITATION
1	E2-Sh2-Rc2	11	F2-D2	21	T2-El2-E2	31	T3-E3-Sh2-Rc3	41	T3-El3-E3-Sh3-Rc2
2	El2	12	Sh2	22	T2-El2-E3-Rc2	32	T3-E3-Sh3-Rc2	42	T3
3	El2-E2-Sh2-Rc3	13	Sh2-Rc2	23	T2-El2-E3-Rc3	33	T3-E3-Sh3-Rc3	43	T3-E3
4	El2-E3-Rc3	14	T2	24	T2-El2-E3-Sh2-Rc2	34	T3-El2	44	T3-E3-Rc3
5	El2-E3-Sh2-Rc3	15	T2-E3	25	T2-El2-E3-Sh2-Rc3	35	T3-El2-E3	45	T3-E3-Sh3-Rc3
6	El2-Rc2	16	T2-E3-Rc2	26	T2-El3-E3-Sh2-Rc2	36	T3-El2-E3-Rc2	46	T3-El2
7	El2-Sh2-Rc2	17	T2-E3-Rc3	27	T2-F2-D2	37	T3-El2-E3-Sh2-Rc3	47	T3-El2-E3
8	El2-Sh2-Rc3	18	T2-E3-Sh2-Rc2	28	T3	38	T3-El2-E3-Sh3-Rc2	48	T3-El2-E3-Rc3
9	El3-Sh2-Rc2	19	T2-E3-Sh2-Rc3	29	T3-E3	39	T3-El2-E3-Sh3-Rc3	49	T3-El2-E3-Sh3-Rc3
10	F2-D2	20	T2-El2	30	T3-E3-Rc2	40	T3-El3-E3-Rc2	50	T3-El3-E3-Sh3-Rc3

CODE	LIMITATION	CODE	LIMITATION
4	Corn	119	Oil palm
81	Coffee	126	Grassland
82	Cacao	131	Ipil-Ipil
85	Mango	134	Shrubs, unmanaged
91	Banana	137	Rubber
98	Rambutan	139	Falcata
105	Fruit trees, mixed		
107	Abaca		
115	Mixed crops		
116	Coconut		

Source: PAGASA 2018, *Climatological Normals (Rainfall)*, Philippine Atmospheric, Geophysical and Astronomical Services Administration (PAGASA), accessed 27 July 2018, <https://www1.pagasa.dost.gov.ph/index.php/climate/climatological-normals>.

LAND SUITABILITY MAP FOR CACAO

LAND RESOURCES EVALUATION AND SUITABILITY ASSESSMENT OF STRATEGIC PRODUCTION AREAS

DINAGAT ISLAND, REGION XIII

EXTENT OF SUITABILITY FOR CACAO PRODUCTION BY MUNICIPALITY

MUNICIPALITY	EXISTING CACAO (Ha)			TOTAL EXISTING AREA (Ha)	EXPANSION AREA (Ha)						CONFLICT RESOLUTION AREA (Ha)						TOTAL POTENTIAL EXPANSION AREA (Ha)
					Coconut		Shrubland, unmanaged*		Grassland, unmanaged*		Corn		Paddy rice, non-irrigated		Other crops		
	S1	S2	S3		S1	S2	S1	S2	S1	S2	S1	S2	S1	S2	S1	S2	
BASILISA	-	-	1	1	325	432	266	266	205	1,092	63	80	-	-	-	-	2,729
CAGDIANAO	-	-	1	1	505	153	185	281	532	950	157	171	-	-	-	-	2,933
DINAGAT	-	-	-	-	757	156	8	1	238	28	63	33	-	-	-	-	1,282
LIBJO	-	-	-	-	306	128	138	933	214	2,636	94	375	-	-	-	-	4,824
LORETO	-	-	-	-	417	550	73	373	132	708	218	289	-	-	-	-	2,760
SAN JOSE	-	-	-	-	277	230	2	99	7	68	15	26	-	-	-	-	724
TUBAJON	1	2	1	3	111	473	20	132	185	1,724	49	89	-	-	-	-	2,782
TOTAL	1	2	2	4	2,696	2,121	693	2,084	1,512	7,208	658	1,063	-	-	-	-	18,035

Note: Delivery of cacao planting materials must be started on the onset of rainy season.
**establishment of shade trees prior to planting of cacao.*

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AGRONOMIC REQUIREMENT OF CACAO PRODUCTION

LAND UTILIZATION TYPE	SUITABILITY RATING	SLOPE (%)	SOIL DEPTH (cm)	SOIL TEXTURE	SOIL DRAINAGE	SOIL REACTION (pH)	INHERENT FERTILITY	FLOODING CLASS	EROSION CLASS	ROCK OUTCROPS	ELEVATION (masl)	ANNUAL RAINFALL (mm)	CLIMATIC TYPE
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	S2	8 - 30	50 - 100	FSL, L, SiL	SPD,PD	5.1 - 5.5 7.3 - 7.8	medium	moderate	moderate	common	1000-1500	1000-2000	I, II
	S3	>30	<50	S, LS, CSL, SL	VPD,ED	<5.0 - > 7.9	low	severe	severe	many	>1500	<1000 >4500	

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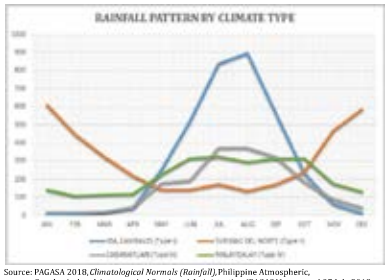
TYPE IV : Rainfall is more or less evenly distributed throughout the year. This type resembles Type II since it has no dry season.

The whole of Dinagat Island is classified as climatic Type II.



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Rc3 - Many

SOIL EROSION
E2 - Moderate erosion
E3 - Severe erosion

FLOODING
F2 - Moderate seasonal flooding
F3 - Severe seasonal flooding

CODE	LIMITATION	CODE	LIMITATION	CODE	LIMITATION
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2	E2-Sh2-Rc2	12	T2-E3-Rc3	22	T3-El2-E3-Sh3-Rc3
3	El2-E3-Rc3	13	T2-El2-E3-Rc3	23	T3-El3
4	El2-Sh2-Rc2	14	T2-F3-D1	24	Tc
5	F2-D1	15	T3		
6	F2-Tc	16	T3-E3		
7	F3-D1	17	T3-E3-Sh2-Rc3		
8	Sh2	18	T3-El2-E3-Sh2-Rc3		
9	Sh2-Rc2	19	T3-F3-D1		
10	T2	20	T3		

CODE	LANDUSE
4	Corn
82	Cacao
116	Coconut
126	Grassland
134	Shrubs, unmanaged

LAND SUITABILITY MAP FOR CACAO

LAND RESOURCES EVALUATION AND SUITABILITY ASSESSMENT OF STRATEGIC PRODUCTION AREAS

SURIGAO DEL NORTE, REGION XIII

EXTENT OF SUITABILITY FOR CACAO PRODUCTION BY MUNICIPALITY

MUNICIPALITY	EXISTING CACAO (Ha)			TOTAL EXISTING AREA (Ha)	EXPANSION AREA (Ha)						CONFLICT RESOLUTION AREA (Ha)						TOTAL POTENTIAL EXPANSION AREA (Ha)
					Coconut		Shrubland, unmanaged*		Grassland, unmanaged*		Corn		Paddy rice, non-irrigated		Other crops		
	S1	S2	S3		S1	S2	S1	S2	S1	S2	S1	S2	S1	S2	S1	S2	
ALEGRIA	3	-	-	-	1,321	56	24	4	6	-	382	-	-	-	-	-	1,793
BACUAG	-	-	-	-	1,350	2	71	-	381	-	528	7	-	-	-	-	2,339
BURGOS	-	-	-	-	861	-	190	-	-	-	207	-	-	-	-	-	1,258
CLAVER	-	-	-	-	711	539	70	122	193	1,210	247	210	-	-	-	-	3,302
DAPA	-	-	-	-	2,318	13	187	9	345	-	305	-	-	-	-	-	3,177
DEL CARMEN	-	-	-	-	4,196	54	906	1	248	-	1,434	-	-	-	-	-	6,839
GENERAL LUNA	-	-	-	-	1,341	-	710	95	-	-	1,302	4	-	-	-	-	3,453
GIGAQUIT	-	-	-	-	1,451	246	218	8	62	-	644	193	-	-	-	-	2,822
MAINIT	-	-	-	-	4,236	14	49	3	139	8	1,289	11	-	-	-	-	5,749
MALIMONO	-	-	-	-	764	135	-	12	80	123	49	6	-	-	-	-	1,169
PILAR	-	-	-	-	2,397	-	427	-	18	-	1,569	-	-	-	-	-	4,411
PLACER	-	-	-	-	1,677	903	19	-	214	15	232	32	-	-	-	-	3,092
SAN BENITO	-	-	-	-	1,150	-	517	5	10	-	88	-	-	-	-	-	1,770
SAN FRANCISCO	-	-	-	-	549	113	-	-	38	24	147	-	-	-	-	-	871
SAN ISIDRO	-	-	-	-	1,981	-	645	-	-	-	1,284	-	-	-	-	-	3,910
SANTA MONICA	-	-	-	-	1,715	5	68	-	4	-	375	5	-	-	-	-	2,171
SISON	-	-	-	-	3,048	408	-	62	191	201	546	67	-	-	-	-	4,340
SOCORRO	-	-	-	-	532	318	331	315	98	1,570	765	881	-	-	-	-	4,808
SURIGAO CITY	-	-	-	-	3,845	954	362	168	1,825	1,285	2,323	594	-	-	-	-	11,356
TAGANA-AN	-	-	-	-	1,467	391	5	2	29	3	130	25	-	-	-	-	2,053
TUBOD	-	-	-	-	1,214	32	47	-	21	-	264	53	-	-	-	-	1,630
TOTAL	-	-	-	-	38,125	4,186	4,847	804	3,901	4,258	14,108	2,088	-	-	-	-	72,316

Note: Delivery of cacao planting materials must be started on the onset of rainy season.
**establishment of shade trees prior to planting of cacao.*

AGRONOMIC REQUIREMENT OF CACAO PRODUCTION

LAND UTILIZATION TYPE	SUITABILITY RATING	SLOPE (%)	SOIL DEPTH (cm)	SOIL TEXTURE	SOIL DRAINAGE	SOIL REACTION (pH)	INHERENT FERTILITY	FLOODING CLASS	EROSION CLASS	ROCK OUTCROPS	ELEVATION (masl)	ANNUAL RAINFALL (mm)	CLIMATIC TYPE
Cacao	S1	<8	>100	CL, SiCL, SCL, SC, SiC, C, HC	WD,MWD	5.6 -7.2	high	none-slight	none-slight	none-few	<1000	2001-4500	I, III, IV
	S2	8 - 30	50 - 100	FSL, L, SiL	SPD,PD	5.1 - 5.5 7.3 - 7.8	medium	moderate	moderate	common	1000-1500	1000-2000	I, II
	S3	>30	<50	S, LS, CSL, SL	VPD,ED	<5.0 - > 7.9	low	severe	severe	many	>1500	<1000 >4500	

SLOPE (%)
0 - 3 - level to gently sloping
3 - 8 - gently sloping to undulating
8 - 18 - undulating to rolling
18 - 30 - rolling to moderately steep
30 - 50 - steep
> 50 - very steep

SOIL DEPTH (cm)
0 - 30 - very shallow
30 - 50 - shallow
50 - 100 - moderately deep
> 100 - deep to very deep

SOIL DRAINAGE
ED - excessively drained
WD - well drained
MWD - moderately well drained
SPD - somewhat poorly drained
PD - poorly drained
VPD - very poorly drained

SURFACE IMPEDIMENT
ROCK OUTCROPS
< 10% - none - few
10 - 30% - common
> 30% - many

SOIL REACTION (pH)
< 4.5 - extremely acid
4.5 - 5.0 - very strongly acid
5.1 - 5.5 - strongly acid
5.6 - 6.0 - medium acid
6.1 - 6.5 - slightly acid
6.6 - 7.2 - neutral
7.3 - 7.8 - mildly alkaline
7.9 - 8.4 - moderately alkaline
> 8.5 - strongly alkaline

SOIL TEXTURE
Coarse
S - sand
LS - loamy sand
CSL - coarse sandy loam
SL - sandy loam
Medium
FSL - fine sandy loam
L - loam
SiL - silt loam
CL - clay loam
SiCL - silty clay loam
SCL - sandy clay loam
Fine
SC - sandy clay
SiC - silty clay
C - clay
HC - heavy clay

LAND LIMITATIONS DESCRIPTION AND COMBINATIONS

ELEVATION
EI2 - 1000m - 1500m
EI3 - > 1500m

SLOPE/TOPOGRAPHY
T2 - Undulating to moderately steep
T3 - Steep to very steep

SOIL DRAINAGE
D2 - Somewhat poorly drained to poorly drained
D3 - Very poorly drained or excessively drained

SOIL TEXTURE
Tc - Coarse texture

SOIL DEPTH
Sh2 - Moderately deep (50 - 100cm)
Sh3 - Very shallow to shallow (< 50cm)

ROCK OUTCROPS
Rc2 - Common
Rc3 - Many

SOIL EROSION
E2 - Moderate erosion
E3 - Severe erosion

FLOODING
F2 - Moderate seasonal flooding
F3 - Severe seasonal flooding

CODE	LIMITATION	CODE	LIMITATION	CODE	LIMITATION	CODE	LIMITATION	CODE	LIMITATION
1	E2	11	T2	21	T2-F3-D2	31	T3-F2-D2	41	Tc
2	E2-Sh2-Rc2	12	T2-E3	22	T3	32	T3-F3-D2		
3	EI2	13	T2-E3-Rc2	23	T3-E3	33	T3		
4	EI2-E3-Rc3	14	T2-E3-Rc3	24	T3-E3-Rc2	34	T3-E3		
5	EI2-Sh2-Rc2	15	T2-E3-Sh2-Rc2	25	T3-E3-Sh2-Rc3	35	T3-E3-Rc3		
6	F2-D2	16	T2-E3-Sh2-Rc3	26	T3-E3-Sh3-Rc2	36	T3-E3-Sh3-Rc3		
7	F2-Tc	17	T2-EI2-E3	27	T3-E3-Sh3-Rc3	37	T3-EI2-E3		
8	F3-D2	18	T2-EI2-E3-Rc3	28	T3-EI2-E3	38	T3-EI2-E3-Sh3-Rc3		
9	Sh2	19	T2-EI2-E3-Sh2-Rc2	29	T3-EI2-E3-Sh2-Rc3	39	T3-F3-D2		
10	Sh2-Rc2	20	T2-F2-D2	30	T3-EI2-E3-Sh3-Rc2	40	T3-EI3		

CODE	LANDUSE
4	Corn
81	Coffee
82	Cacao
116	Coconut
126	Grassland
134	Shrubs, unmanaged

SUITABILITY CLASSES:

Highly Suitable (S1)
Land having no significant limitation to sustained application of a given use, or only minor limitations that will not significantly reduce productivity or benefits and will not raise inputs above an acceptable level.

Marginally Suitable (S3)
Land having limitations which in aggregate are severe for sustained application of a given use and will so reduce productivity or benefits, or increase required inputs, that this expenditure will be only marginally justified.

Moderately Suitable (S2)
Land having limitation which in aggregate are moderately severe for sustained application of a given use; the limitation will reduce productivity or benefits and increase required inputs to the extent that the overall advantage to be gained from the use, although still attractive, will be appreciably inferior to that expected on class S1 land.

Not Suitable / Not Relevant
Land having limitations which may be surmountable in time but which cannot be corrected with existing knowledge at currently acceptable cost; the limitations are so severe as to preclude successful sustained use of the land in the given manner. Existing forest, shrubland greater than 18% slope, irrigated paddy rice and miscellaneous land types such as built up areas, roads, etc are considered as not relevant.

CLIMATE TYPE

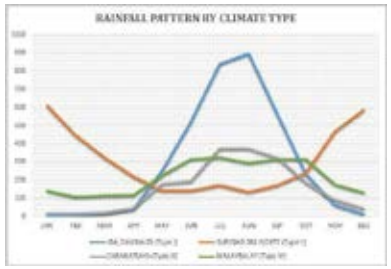
TYPE I : Two pronouced season, dry from November to April and wet during the rest of the year. Maximum rain period is from June to September

TYPE II : No dry season with a very pronounced maximum rain period from December to February. There is not a single dry month. Maximum monthly rainfall occurs during the period from March to May.

TYPE III : No very pronounced maximum rain period, with a dry season lasting only from one to three months, either during the period from December to February or from March to May. This type resembles Type I since it has a short dry season.

TYPE IV : Rainfall is more or less evenly distributed throughout the year, This type resembles Type II since it has no dry season.

Surigao Del Norte is classified as climatic Type II



Source: PAGASA 2018, *Climatological Normals (Rainfall)*, Philippine Atmospheric, Geophysical and Astronomical Services Administration (PAGASA), accessed 27 July 2018, <https://www1.pagasa.dost.gov.ph/index.php/climate/climatological-normals>.

LAND SUITABILITY MAP FOR CACAO

LAND RESOURCES EVALUATION AND SUITABILITY ASSESSMENT OF STRATEGIC PRODUCTION AREAS

SURIGAO DEL SUR, REGION XIII

EXTENT OF SUITABILITY FOR CACAO PRODUCTION BY MUNICIPALITY

MUNICIPALITY	EXISTING CACAO (Ha)			TOTAL EXISTING AREA (Ha)	EXPANSION AREA (Ha)						CONFLICT RESOLUTION AREA (Ha)						TOTAL POTENTIAL EXPANSION AREA (Ha)
					Coconut		Shrubland, unmanaged*		Grassland, unmanaged*		Corn		Paddy rice, non-irrigated		Other crops		
	S1	S2	S3		S1	S2	S1	S2	S1	S2	S1	S2	S1	S2	S1	S2	
BAROBO	-	-	-	-	11,830	2,063	715	25	64	9	517	42	-	-	-	-	15,264
BAYABAS	-	-	-	-	1,620	36	141	-	-	-	278	25	-	-	-	-	2,101
CAGWAIT	-	-	-	-	2,852	54	69	-	-	-	322	-	-	-	-	-	3,296
CANTILAN	-	-	-	-	791	420	29	81	38	100	1,808	143	-	-	-	-	3,409
CARMEN	-	-	-	-	635	54	39	198	23	94	273	17	-	-	-	-	1,334
CARRASCAL	-	-	-	-	228	510	596	754	109	927	308	33	-	-	-	-	3,467
CITY OF BISLIG	3	-	-	3	12,730	1,754	2,471	71	549	82	1,280	5	-	-	-	-	18,943
CITY OF TANDAG	-	-	-	-	1,308	2,795	230	86	22	124	322	337	-	-	-	-	5,225
CORTES	-	-	-	-	711	1,643	1	38	-	-	91	43	-	-	-	-	2,529
HINATUAN	-	-	-	-	14,187	10,068	338	593	547	156	383	22	-	-	-	-	26,293
LANUZA	-	-	-	-	790	297	3	274	18	281	129	2	-	-	-	-	1,795
LIANGA	1	-	1	2	2,575	978	177	169	-	137	77	-	-	-	-	-	4,112
LINGIG	-	-	-	-	2,650	7	806	-	158	-	83	-	-	-	-	-	3,704
MADRID	-	-	-	-	658	492	12	47	43	20	1,594	38	-	-	-	-	2,904
MARIHATAG	-	-	-	-	4,262	329	171	471	-	73	810	-	-	-	-	-	6,117
SAN AGUSTIN	-	-	-	-	1,912	216	98	582	8	163	497	-	-	-	-	-	3,475
SAN MIGUEL	-	-	-	-	3,178	522	777	472	335	169	5,745	100	-	-	-	-	11,299
TAGBINA	-	-	-	-	24,841	6,486	370	90	1,102	313	190	34	-	-	-	-	33,427
TAGO	-	-	-	-	2,921	1,462	182	1	15	14	3,707	2,890	-	-	-	-	11,192
TOTAL	4	-	1	5	90,680	30,188	7,221	3,955	3,031	2,663	18,415	3,732	-	-	-	-	159,885

Note: Delivery of cacao planting materials must be started on the onset of rainy season.
**establishment of shade trees prior to planting of cacao.*

AGRONOMIC REQUIREMENT OF CACAO PRODUCTION

LAND UTILIZATION TYPE	SUITABILITY RATING	SLOPE (%)	SOIL DEPTH (cm)	SOIL TEXTURE	SOIL DRAINAGE	SOIL REACTION (pH)	INHERENT FERTILITY	FLOODING CLASS	EROSION CLASS	ROCK OUTCROPS	ELEVATION (masl)	ANNUAL RAINFALL (mm)	CLIMATIC TYPE
Cacao	S1	<8	>100	CL, SiCL, SCL, SC, SiC, C, HC	WD,MWD	5.6 -7.2	high	none-slight	none-slight	none-few	<1000	2001-4500	I, III, IV
	S2	8 - 30	50 - 100	FSL, L, SiL	SPD,PD	5.1 - 5.5 7.3 - 7.8	medium	moderate	moderate	common	1000-1500	1000-2000	I, II
	S3	>30	<50	S, LS, CSL, SL	VPD,ED	<5.0 - > 7.9	low	severe	severe	many	>1500	<1000 >4500	

SLOPE (%)
0 - 3 - level to gently sloping
3 - 8 - gently sloping to undulating
8 - 18 - undulating to rolling
18 - 30 - rolling to moderately steep
30 - 50 - steep
> 50 - very steep

SOIL DEPTH (cm)
0 - 30 - very shallow
30 - 50 - shallow
50 - 100 - moderately deep
> 100 - deep to very deep

SOIL DRAINAGE
ED - excessively drained
WD - well drained
MWD - moderately well drained
SPD - somewhat poorly drained
PD - poorly drained
VPD - very poorly drained

SURFACE IMPEDIMENT
ROCK OUTCROPS
< 10% - none - few
10 - 30% - common
> 30% - many

SOIL REACTION (pH)
< 4.5 - extremely acid
4.5 - 5.0 - very strongly acid
5.1 - 5.5 - strongly acid
5.6 - 6.0 - medium acid
6.1 - 6.5 - slightly acid
6.6 - 7.2 - neutral
7.3 - 7.8 - mildly alkaline
7.9 - 8.4 - moderately alkaline
> 8.5 - strongly alkaline

SOIL TEXTURE
Coarse
S - sand
LS - loamy sand
CSL - coarse sandy loam
SL - sandy loam
Medium
FSL - fine sandy loam
L - loam
SiL - silt loam
CL - clay loam
SiCL - silty clay loam
SCL - sandy clay loam
Fine
SC - sandy clay
SiC - silty clay
C - clay
HC - heavy clay

LAND LIMITATIONS DESCRIPTION AND COMBINATIONS

ELEVATION
El2 - 1000m - 1500m
El3 - > 1500m

SLOPE/TOPOGRAPHY
T2 - Undulating to moderately steep
T3 - Steep to very steep

SOIL DRAINAGE
D2 - Somewhat poorly drained to poorly drained
D3 - Very poorly drained or excessively drained

SOIL TEXTURE
Tc - Coarse texture

SOIL DEPTH
Sh2 - Moderately deep (50 - 100cm)
Sh3 - Very shallow to shallow (< 50cm)

ROCK OUTCROPS
Rc2 - Common
Rc3 - Many

SOIL EROSION
E2 - Moderate erosion
E3 - Severe erosion

FLOODING
F2 - Moderate seasonal flooding
F3 - Severe seasonal flooding

CODE	LIMITATION	CODE	LIMITATION	CODE	LIMITATION	CODE	LIMITATION	CODE	LIMITATION
1	E2-Sh2-Rc2	11	F3-D2	21	T2-El2-E3	31	T3-E3-Sh2-Rc3	41	T3
2	El2	12	Sh2	22	T2-El2-E3-Rc2	32	T3-E3-Sh3-Rc2	42	T3-E3
3	El2-E2-Sh2-Rc3	13	Sh2-Rc2	23	T2-El2-E3-Rc3	33	T3-E3-Sh3-Rc3	43	T3-E3-Sh3-Rc3
4	El2-E3-Rc3	14	T2	24	T2-El2-E3-Sh2-Rc2	34	T3-El2	44	T3-El2
5	El2-E3-Sh2-Rc3	15	T2-E3	25	T2-El2-E3-Sh2-Rc3	35	T3-El2-E3-Rc2	45	T3-El2-E3
6	El2-Rc2	16	T2-E3-Rc2	26	T2-F2-D2	36	T3-El2-E3-Sh2-Rc3	46	T3-El2-E3-Rc3
7	El2-Sh2-Rc2	17	T2-E3-Rc3	27	T2-F3-D2	37	T3-El2-E3-Sh3-Rc2	47	T3-El2-E3-Sh3-Rc3
8	El2-Sh2-Rc3	18	T2-E3-Sh2-Rc2	28	T3	38	T3-El2-E3-Sh3-Rc3	48	T3-El3
9	F2-D2	19	T2-E3-Sh2-Rc3	29	T3-E3	39	T3-F2-D2	49	Tc
10	F2-Tc	20	T2-El2	30	T3-E3-Rc2	40	T3-F3-D2		

CODE	LANDUSE
4	Corn
81	Coffee
82	Cacao
116	Coconut
126	Grassland
134	Shrubs, unmanaged
136	Forest

SUITABILITY CLASSES:

Highly Suitable (S1)
Land having no significant limitation to sustained application of a given use, or only minor limitations that will not significantly reduce productivity or benefits and will not raise inputs above an acceptable level.

Moderately Suitable (S2)
Land having limitation which in aggregate are moderately severe for sustained application of a given use; the limitation will reduce productivity or benefits and increase required inputs to the extent that the overall advantage to be gained from the use, although still attractive, will be appreciably inferior to that expected on class S1 land.

Marginally Suitable (S3)
Land having limitations which in aggregate are severe for sustained application of a given use and will so reduce productivity or benefits, or increase required inputs, that this expenditure will be only marginally justified.

Not Suitable / Not Relevant
Land having limitations which may be surmountable in time but which cannot be corrected with existing knowledge at currently acceptable cost; the limitations are so severe as to preclude successful sustained use of the land in the given manner. Existing forest, shrubland greater than 18% slope, irrigated paddy rice and miscellaneous land types such as built up areas, roads, etc are considered as not relevant.

CLIMATE TYPE

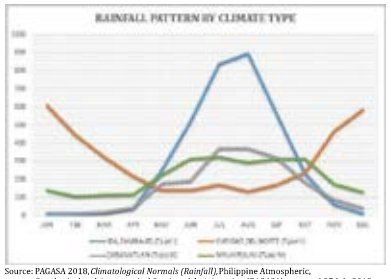
TYPE I : Two pronounced season, dry from November to April and wet during the rest of the year. Maximum rain period is from June to September

TYPE II : No dry season with a very pronounced maximum rain period from December to February. There is not a single dry month. Maximum monthly rainfall occurs during the period from March to May.

TYPE III : No very pronounced maximum rain period, with a dry season lasting only from one to three months, either during the period from December to February or from March to May. This type resembles Type I since it has a short dry season.

TYPE IV : Rainfall is more or less evenly distributed throughout the year. This type resembles Type II since it has no dry season.

Surigao Del Sur is classified as climatic Type II.



Source: PAGASA 2018, *Climatological Normals (Rainfall)*, Philippine Atmospheric, Geophysical and Astronomical Services Administration (PAGASA), accessed 27 July 2018, <https://www1.pagasa.dost.gov.ph/index.php/climate/climatological-normals>.

LAND SUITABILITY MAP FOR CACAO

LAND RESOURCES EVALUATION AND SUITABILITY ASSESSMENT OF STRATEGIC PRODUCTION AREAS

PROVINCE OF BASILAN, ARMM

EXTENT OF SUITABILITY FOR CACAO PRODUCTION BY MUNICIPALITY

MUNICIPALITY	EXISTING CACAO (Ha)			TOTAL EXISTING AREA (Ha)	EXPANSION AREA (Ha)						CONFLICT RESOLUTION (Ha)						TOTAL POTENTIAL EXPANSION AREA (Ha)
					Coconut		Shrubland, unmanaged*		Grassland, unmanaged*		Corn		Paddy rice, non-irrigated		Other crops		
	S1	S2	S3		S1	S2	S1	S2	S1	S2	S1	S2	S1	S2	S1	S2	
AKBAR	-	-	-	-	1,083	1,272	-	-	9	10	-	-	-	-	-	-	2,374
AL-BARKA	-	-	-	-	582	2,733	-	-	5	-	-	-	-	-	-	-	3,320
CITY OF LAMITAN	-	-	-	-	9,290	6,902	21	52	82	-	-	-	-	-	-	-	16,348
HADJI MOHAMMAD AJUL	-	-	-	-	2,364	1,791	-	-	124	33	-	-	-	-	-	-	4,311
HADJI MUHTAMAD	-	-	-	-	-	13	-	-	-	409	-	-	-	-	-	-	422
LANTAWAN	-	-	-	-	8,572	1,900	6	-	32	-	-	-	-	-	-	-	10,511
MALUSO	-	-	-	-	4,669	597	5	-	67	-	-	-	-	-	-	-	5,337
SUMISIP	-	-	-	-	4,552	8,475	7	15	-	-	-	-	-	-	-	-	13,049
TABUAN-LASA	-	-	-	-	51	-	-	-	267	5	-	-	-	-	-	-	323
TIPO-TIPO	-	-	-	-	1,467	2,278	-	-	-	-	-	-	-	-	-	-	3,744
TUBURAN	-	-	-	-	1,921	1,151	-	-	-	-	-	-	-	-	-	-	3,073
UNGKAYA PUKAN	-	-	-	-	394	3,947	-	-	-	-	-	-	-	-	-	-	4,331
Total Area (Ha)	-	-	-	-	34,935	31,059	39	68	586	456	-	-	-	-	-	-	**67,143**

Note: Delivery of cacao planting materials must be started on the onset of rainy season.
**establishment of shade trees prior to planting of cacao.*

SUITABILITY CLASSES:

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Land having no significant limitation to sustained application of a given use, or only minor limitations that will not significantly reduce productivity or benefits and will not raise inputs above an acceptable level.

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AGRONOMIC REQUIREMENT OF CACAO PRODUCTION

LAND UTILIZATION TYPE	SUITABILITY RATING	SLOPE (%)	SOIL DEPTH (cm)	SOIL TEXTURE	SOIL DRAINAGE	SOIL REACTION (pH)	INHERENT FERTILITY	FLOODING CLASS	EROSION CLASS	ROCK OUTCROPS	ELEVATION (masl)	ANNUAL RAINFALL (mm)	CLIMATIC TYPE
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	S2	8 - 30	50 - 100	FSL, L, SiL	SPD,PD	5.1 - 5.5 7.3 - 7.8	medium	moderate	moderate	common	1000-1500	1000-2000	I, II
	S3	>30	<50	S, LS, CSL, SL	VPD,ED	<5.0 - > 7.9	low	severe	severe	many	>1500	<1000 >4500	

SLOPE (%)
0 - 3 - level to gently sloping
3 - 8 - gently sloping to undulating
8 - 18 - undulating to rolling
18 - 30 - rolling to moderately steep
30 - 50 - steep
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SOIL DEPTH (cm)
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SOIL DRAINAGE
ED - excessively drained
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MWD - moderately well drained
SPD - somewhat poorly drained
PD - poorly drained
VPD - very poorly drained

SURFACE IMPEDIMENT
ROCK OUTCROPS
< 10% - none - few
10 - 30% - common
> 30% - many

SOIL REACTION (pH)
< 4.5 - extremely acid
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6.1 - 6.5 - slightly acid
6.6 - 7.2 - neutral
7.3 - 7.8 - mildly alkaline
7.9 - 8.4 - moderately alkaline
> 8.5 - strongly alkaline

SOIL TEXTURE
Coarse
S - sand
LS - loamy sand
CSL - coarse sandy loam
SL - sandy loam
Medium
FSL - fine sandy loam
L - loam
SiL - silt loam
CL - clay loam
SiCL - silty clay loam
SCL - sandy clay loam
Fine
SC - sandy clay
SiC - silty clay
C - clay
HC - heavy clay

LAND LIMITATIONS DESCRIPTION AND COMBINATIONS

ELEVATION
El2 - 1000m - 1500m
El3 - > 1500m

SLOPE/TOPOGRAPHY
T2 - Undulating to moderately steep
T3 - Steep to very steep

SOIL DRAINAGE
D2 - Somewhat poorly drained to poorly drained
D3 - Very poorly drained or excessively drained

SOIL TEXTURE
Tc - Coarse texture

SOIL DEPTH
Sh2 - Moderately deep (50 - 100cm)
Sh3 - Very shallow to shallow (< 50cm)

ROCK OUTCROPS
Rc2 - Common
Rc3 - Many

SOIL EROSION
E2 - Moderate erosion
E3 - Severe erosion

FLOODING
F2 - Moderate seasonal flooding
F3 - Severe seasonal flooding

CODE	LIMITATION	CODE	LIMITATION	CODE	LIMITATION
1	E2-Sh2-Rc2	11	T2-E3-Sh2-Rc2	21	T3-E3
2	El2	12	T2-E3-Sh2-Rc3	22	T3-E3-Sh3-Rc3
3	El2-E3-Sh2-Rc3	13	T2-El2-E3-Sh2-Rc2	23	T3-El2-E3-Sh3-Rc3
4	El2-Sh2-Rc2	14	T2-El2-E3-Sh2-Rc3	24	T3-F3-D2
5	F2-D2	15	T2-F3-D2	25	T3-El3
6	F2-Tc	16	T3-E3		
7	F3-D2	17	T3-E3-Sh3-Rc2		
8	Sh2-Rc2	18	T3-E3-Sh3-Rc3		
9	T2	19	T3-El2-E3-Sh3-Rc2		
10	T2-E3	20	T3-F3-D2		

CODE	LANDUSE
2	Paddy rice, non-irrigated
116	Coconut
126	Grassland
134	Shrubs, unmanaged
137	Rubber

CLIMATE TYPE

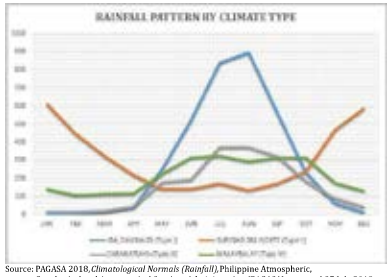
TYPE I : Two pronouced season, dry from November to April and wet during the rest of the year. Maximum rain period is from June to September

TYPE II : No dry season with a very pronounced maximum rain period from December to February. There is not a single dry month. Maximum monthly rainfall occurs during the period from March to May.

TYPE III : No very pronounced maximum rain period, with a dry season lasting only from one to three months, either during the period from December to February or from March to May. This type resembles Type I since it has a short dry season.

TYPE IV : Rainfall is more or less evenly distributed throughout the year. This type resembles Type II since it has no dry season.

The whole part of Basilan is classified as climate Type IV.



Source: PAGASA 2018, *Climatological Normals (Rainfall)*, Philippine Atmospheric, Geophysical and Astronomical Services Administration (PAGASA), accessed 27 July 2018, <https://www1.pagasa.dost.gov.ph/index.php/climate/climatological-normals>.

LAND SUITABILITY MAP FOR CACAO

LAND RESOURCES EVALUATION AND SUITABILITY ASSESSMENT OF STRATEGIC PRODUCTION AREAS

PROVINCE OF LANAO DEL SUR, ARMM

EXTENT OF SUITABILITY FOR CACAO PRODUCTION BY MUNICIPALITY

MUNICIPALITY	EXISTING CACAO (Ha)			TOTAL EXISTING AREA (Ha)	EXPANSION AREA (Ha)						CONFLICT RESOLUTION (Ha)						TOTAL POTENTIAL EXPANSION AREA (Ha)
					Coconut		Shrubland, unmanaged*		Grassland, unmanaged*		Corn		Paddy rice, non-irrigated		Other crops		
	S1	S2	S3		S1	S2	S1	S2	S1	S2	S1	S2	S1	S2	S1	S2	
BACOLOD-KALAWI	-	-	-	-	-	98	-	-	-	-	-	-	-	-	-	-	98
BALABAGAN	-	-	-	-	4,528	-	-	-	-	0	-	189	-	-	-	-	4,717
BALINDONG	-	-	-	-	-	309	-	100	-	42	-	705	-	-	-	-	1,157
BAYANG	-	-	-	-	-	269	-	125	-	-	-	649	-	-	-	-	1,043
BINIDAYAN	-	-	-	-	-	154	-	69	-	-	-	519	-	-	-	-	742
BUADIPOSO-BUNTONG	-	-	-	-	-	-	-	69	-	2	-	1,057	-	-	-	-	1,128
BUBONG	-	-	-	-	-	-	-	155	-	1	-	1,977	-	-	-	-	2,133
BUMBARAN	-	-	-	-	-	2	-	914	-	387	-	6,239	-	-	-	-	7,543
BUTIG	-	-	-	-	-	100	-	98	-	155	-	1,210	-	-	-	-	1,562
CALANOGAS	-	-	-	-	1,152	1,014	-	70	-	559	-	819	-	-	-	-	3,614
DITSAAN-RAMAIN	-	-	-	-	-	-	-	12	-	-	-	733	-	-	-	-	744
GANASSI	-	-	-	-	-	130	-	34	-	-	-	812	-	-	-	-	976
KAPAI	-	-	-	-	-	-	-	564	-	-	-	1,680	-	-	-	-	2,244
KAPATAGAN	-	-	-	-	2,377	39	150	7	59	-	62	17	-	-	-	-	2,710
LUMBA-BAYABAO	-	-	-	-	-	-	-	70	-	92	-	1,423	-	-	-	-	1,585
LUMBACA-UNAYAN	-	-	-	-	20	223	-	87	-	-	-	761	-	-	-	-	1,091
LUMBATAN	-	-	-	-	-	93	-	17	-	-	-	1,084	-	-	-	-	1,193
LUMBAYANAGUE	-	-	-	-	-	47	-	38	-	-	-	328	-	-	-	-	413
MADALUM	-	-	-	-	-	42	-	65	-	240	-	539	-	-	-	-	885
MADAMBA	-	-	-	-	-	-	-	264	-	165	-	1,046	-	-	-	-	1,475
MAGUING	-	-	-	-	-	-	-	250	-	2,872	-	6,415	-	-	-	-	9,536
MALABANG	-	-	-	-	2,498	40	43	-	61	152	336	-	-	-	-	-	3,129
MARANTAO	-	-	-	-	-	342	-	16	-	11	-	1,968	-	-	-	-	2,336
MARAWI CITY	-	-	-	-	-	7	-	145	-	95	-	2,277	-	-	-	-	2,524
MAROGONG	-	-	1	1	6,893	1,850	143	394	-	7	433	63	-	-	-	-	9,782
MASIU	-	-	-	-	-	-	-	19	-	204	-	1,156	-	-	-	-	1,379
MULONDO	-	-	-	-	-	-	-	101	-	221	-	593	-	-	-	-	916
PAGAYAWAN	-	-	-	-	131	521	8	54	-	-	-	2,106	-	-	-	-	2,820
PIAGAPO	-	-	-	-	-	8	2	185	-	9	-	1,804	-	-	-	-	2,008
PICONG	-	-	-	-	4,674	163	4	-	17	33	-	-	-	-	-	-	4,891
POONA BAYABAO	-	-	-	-	-	-	-	25	-	58	-	868	-	-	-	-	950
PUALAS	-	-	-	-	-	251	-	178	-	482	-	949	-	-	-	-	1,859
SAGUIARAN	-	-	-	-	-	1	65	159	-	8	-	436	-	-	-	-	668
SULTAN DUMALONDONG	-	-	-	-	-	51	-	-	-	-	-	524	-	-	-	-	575
TAGOLOAN II	-	-	-	-	-	0	112	64	-	891	-	208	-	-	-	-	1,276
TAMPARAN	-	-	-	-	-	-	-	9	-	-	-	457	-	-	-	-	465
TARAKA	-	-	-	-	-	-	-	-	-	17	-	610	-	-	-	-	627
TUBARAN	-	-	-	-	289	743	-	87	7	34	5	1,223	-	-	6,022	1,669	2,389
TUGAYA	-	-	-	-	-	142	-	25	-	21	-	84	-	-	-	-	272
WAO	-	-	-	-	14	-	68	427	-	917	1,636	5,189	-	-	6,022	1,669	15,942
Total Area (Ha)	-	-	1	**1**	22,577	6,639	595	4,891	144	7,674	2,661	48,527	-	-	6,022	1,669	**101,401**

Note: Delivery of cacao planting materials must be started on the onset of rainy season.
**establishment of shade trees prior to planting of cacao.*

SUITABILITY CLASSES:

Highly Suitable (S1)
Land having no significant limitation to sustained application of a given use, or only minor limitations that will not significantly reduce productivity or benefits and will not raise inputs above an acceptable level,

Marginally Suitable (S3)
Land having limitations which in aggregate are severe for sustained application of a given use and will so reduce productivity or benefits, or increase required inputs, that this expenditure will be only marginally justified,

Moderately Suitable (S2)
Land having limitation which in aggregate are moderately severe for sustained application of a given use; the limitation will reduce productivity or benefits and increase required inputs to the extent that the overall advantage to be gained from the use, although still attractive, will be appreciably inferior to that expected on class S1 land.

Not Suitable / Not Relevant
Land having limitations which may be surmountable in time but which cannot be corrected with existing knowledge at currently acceptable cost; the limitations are so severe as to preclude successful sustained use of the land in the given manner, Existing forest, shrubland greater than 18% slope, irrigated paddy rice and miscellaneous land types such as built up areas, roads, etc are considered as not relevant,

CLIMATE TYPE

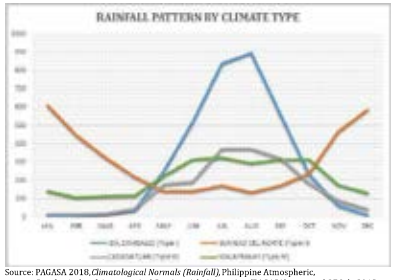
TYPE I : Two pronouced season, dry from November to April and wet during the rest of the year, Maximum rain period is from June to September

TYPE II : No dry season with a very pronounced maximum rain period from December to February, There is not a single dry month, Maximum monthly rainfall occurs during the period from March to May.

TYPE III : No very pronounced maximum rain period, with a dry season lasting only from one to three months, either during the period from December to February or from March to May, This type resembles Type I since it has a short dry season.

TYPE IV : Rainfall is more or less evenly distributed throughout the year, This type resembles Type II since it has no dry season,

Lanao Del Sur is classified as climatic Type III.



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CODE	LANDUSE
2	Paddy rice, non-irrigated
4	Corn
81	Coffee
82	Cacao
112	Sugarcane
116	Coconut
126	Grassland
134	Shrubs, unmanaged

AGRONOMIC REQUIREMENT OF CACAO PRODUCTION

LAND UTILIZATION TYPE	SUITABILITY RATING	SLOPE (%)	SOIL DEPTH (cm)	SOIL TEXTURE	SOIL DRAINAGE	SOIL REACTION (pH)	INHERENT FERTILITY	FLOODING CLASS	EROSION CLASS	ROCK OUTCROPS	ELEVATION (masl)	ANNUAL RAINFALL (mm)	CLIMATIC TYPE
Cacao	S1	<8	>100	CL, SiCL, SCL, SC, SiC, C, HC	WD,MWD	5.6 -7.2	high	none-slight	none-slight	none-few	<1000	2001-4500	I, III, IV
	S2	8 - 30	50 - 100	FSL, L, SiL	SPD,PD	5.1 - 5.5 7.3 - 7.8	medium	moderate	moderate	common	1000-1500	1000-2000	I, II
	S3	>30	<50	S, LS, CSL, SL	VPD,ED	<5.0 - > 7.9	low	severe	severe	many	>1500	<1000 >4500	

SLOPE (%)
0 - 3 - level to gently sloping
3 - 8 - gently sloping to undulating
8 - 18 - undulating to rolling
18 - 30 - rolling to moderately steep
30 - 50 - steep
> 50 - very steep

SOIL DRAINAGE
ED - excessively drained
WD - well drained
MWD - moderately well drained
SPD - somewhat poorly drained
PD - poorly drained
VPD - very poorly drained

SOIL REACTION (pH)
< 4,5 - extremely acid
4,5 - 5,0 - very strongly acid
5,1 - 5,5 - strongly acid
5,6 - 6,0 - medium acid
6,1 - 6,5 - slightly acid
6,6 - 7,2 - neutral
7,3 - 7,8 - mildly alkaline
7,9 - 8,4 - moderately alkaline
> 8,5 - strongly alkaline

SOIL TEXTURE
Coarse
S - sand
LS - loamy sand
CSL - coarse sandy loam
SL - sandy loam
Medium
FSL - fine sandy loam
L - loam
SiL - silt loam
CL - clay loam
SiCL - silty clay loam
SCL - sandy clay loam
Fine
SC - sandy clay
SiC - silty clay
C - clay
HC - heavy clay

SOIL DEPTH (cm)
0 - 30 - very shallow
30 - 50 - shallow
50 - 100 - moderately deep
> 100 - deep to very deep

SURFACE IMPEDIMENT
ROCK OUTCROPS
< 10% - none - few
10 - 30% - common
> 30% - many

LAND LIMITATIONS DESCRIPTION AND COMBINATIONS

ELEVATION
El2 - 1000m - 1500m
El3 - > 1500m

SOIL DRAINAGE
D2 - Somewhat poorly drained to poorly drained
D3 - Very poorly drained or excessively drained

SOIL DEPTH
Sh2 - Moderately deep (50 - 100cm)
Sh3 - Very shallow to shallow (< 50cm)

SOIL EROSION
E2 - Moderate erosion
E3 - Severe erosion

SLOPE/TOPOGRAPHY
T2 - Undulating to moderately steep
T3 - Steep to very steep

SOIL TEXTURE
Tc - Coarse texture

ROCK OUTCROPS
Rc2 - Common
Rc3 - Many

FLOODING
F2 - Moderate seasonal flooding
F3 - Severe seasonal flooding

CODE	LIMITATION	CODE	LIMITATION	CODE	LIMITATION	CODE	LIMITATION	CODE	LIMITATION	CODE	LIMITATION
1	E2-Sh2-Rc2	11	El3-Sh2-Rc2	21	T2-El2	31	T3	41	T3-El3	51	T3-El3
2	El2	12	El3-Sh2-Rc3	22	T2-El2-E3	32	T3-E3	42	T3-El3-E3-Sh3-Rc2	52	T3-El3-E3-Sh3-Rc3
3	El2-E2-Sh2-Rc3	13	F2-D2	23	T2-El2-E3-Rc2	33	T3-E3-Sh3-Rc2	43	T3-El3-E3-Sh3-Rc3	53	T3-El3
4	El2-F2-D2	14	F2-Tc	24	T2-El2-E3-Sh2-Rc2	34	T3-E3-Sh3-Rc3	44	T3-F3-D2		
5	El2-F3-D2	15	F3-D2	25	T2-El2-E3-Sh2-Rc3	35	T3-El2	45	T3		
6	El2-Rc2	16	Sh2-Rc2	26	T2-El2-F2-D2	36	T3-El2-E3	46	T3-E3		
7	El2-Sh2-Rc2	17	T2	27	T2-El3	37	T3-El2-E3-Rc2	47	T3-E3-Sh3-Rc3		
8	El2-Sh2-Rc3	18	T2-E3	28	T2-El3-E3-Sh2-Rc2	38	T3-El2-E3-Sh3-Rc2	48	T3-El2		
9	El3	19	T2-E3-Sh2-Rc2	29	T2-El3-E3-Sh2-Rc3	39	T3-El2-E3-Sh3-Rc3	49	T3-El2-E3		
10	El3-E2-Sh2-Rc3	20	T2-E3-Sh2-Rc3	30	T2-F3-D2	40	T3-El2-F2-D2	50	T3-El2-E3-Sh3-Rc3		

LAND SUITABILITY MAP FOR CACAO

LAND RESOURCES EVALUATION AND SUITABILITY ASSESSMENT OF STRATEGIC PRODUCTION AREAS

PROVINCE OF MAGUINDANAO, ARMM

EXTENT OF SUITABILITY FOR CACAO PRODUCTION BY MUNICIPALITY

MUNICIPALITY	EXISTING CACAO (Ha)			TOTAL EXISTING AREA (Ha)	EXPANSION AREA (Ha)						CONFLICT RESOLUTION (Ha)						TOTAL POTENTIAL EXPANSION AREA (Ha)
					Coconut		Shrubland, unmanaged*		Grassland, unmanaged*		Corn		Paddy rice, non-irrigated		Other crops		
	S1	S2	S3		S1	S2	S1	S2	S1	S2	S1	S2	S1	S2	S1	S2	
AMPATUAN	-	-	-	-	250	56	-	39	44	1,239	1,869	1,199	-	-	-	-	4,696
BARIRA	-	-	-	-	3,818	5,566	-	105	-	-	1,032	343	-	-	-	-	10,864
BULDON	-	-	-	-	2,753	3,183	92	19	1,003	192	934	421	-	-	-	-	8,597
BULUAN	-	-	-	-	1,000	-	0	-	1	-	2,583	-	-	-	-	-	3,584
DATU ABDULLAH SANGKI	-	-	-	-	582	66	-	-	-	-	3,124	159	-	-	-	-	3,931
DATU ANGGAL MIDTIMBANG	-	-	-	-	895	56	-	2	-	6	381	12	-	-	-	-	1,353
DATU BLAH T. SINSUAT	-	-	-	-	2,492	590	95	123	481	521	66	70	-	-	-	-	4,438
DATU HOFFER AMPATUAN	-	-	-	-	190	2	-	-	17	1,207	158	372	-	-	-	-	1,946
DATU ODIN SINSUAT	-	-	-	-	2,784	970	66	1,963	46	4,327	621	1,569	-	-	-	-	12,347
DATU PAGLAS	-	-	-	-	522	-	43	-	1,697	-	2,989	-	-	-	-	-	5,251
DATU PIANG	-	-	-	-	694	21	60	84	-	-	1,234	17	-	-	-	-	2,110
DATU SALIBO	-	-	-	-	120	-	-	-	-	-	591	5	-	-	-	-	716
DATU SAUDI-AMPATUAN	-	-	-	-	196	15	13	140	20	64	1,356	2	-	-	-	-	1,806
DATU UNSAY	-	-	-	-	315	31	1	113	0	1,814	364	371	-	-	-	-	3,009
GEN. S.K. PENDATUN	-	-	-	-	1,343	-	-	-	-	-	1,051	-	-	-	-	-	2,394
GUINDULUNGAN	-	-	-	-	794	160	98	845	338	2,157	1,356	162	-	-	-	-	5,910
KABUNTALAN	-	-	-	-	609	4	168	-	-	-	1,080	0	-	-	-	-	1,861
MAMASAPANO	-	-	-	-	667	17	-	-	-	-	1,037	43	-	-	-	-	1,764
MANGUDADATU	-	-	-	-	377	-	65	-	168	-	439	-	-	-	-	-	1,050
MATANOG	-	-	-	-	1,738	3,246	41	82	-	-	102	310	-	-	-	-	5,539
NORTHERN KABUNTALAN	-	-	-	-	58	-	-	-	-	-	3,720	-	-	-	-	-	3,778
PAGAGAWAN	-	-	-	-	2,035	-	-	-	-	-	4,465	-	-	-	-	-	6,500
PAGALUNGAN	-	-	-	-	2,642	-	-	-	-	-	978	-	-	-	-	-	3,620
PAGLAT	-	-	-	-	573	-	-	-	-	-	934	9	-	-	-	-	1,515
PANDAG	-	-	-	-	848	-	13	-	12	-	1,836	-	-	-	-	-	2,709
PARANG	-	-	-	-	3,231	2,637	-	-	2,575	334	418	24	-	-	-	-	9,218
RAJAH BUAYAN	-	-	-	-	515	11	381	379	-	-	3,315	44	-	-	-	-	4,644
SHARIFF AGUAK	-	-	-	-	205	-	-	-	23	65	674	10	-	-	-	-	978
SHARIFF SAYDONA MUSTAPHA	-	-	-	-	285	60	269	553	-	-	2,156	10	-	-	-	-	3,332
SOUTH UPI	-	-	-	-	1	2,317	22	307	22	1,058	362	6,347	-	-	-	-	10,437
SULTAN KUDARAT	-	-	-	-	8,771	27	30	-	1,419	161	2,370	-	-	-	-	-	12,777
SULTAN MASTURA	-	-	-	-	2,257	184	-	-	884	38	898	2	-	-	-	-	4,263
SULTAN SA BARONGIS	-	-	-	-	962	-	-	-	-	-	2,632	13	-	-	-	-	3,606
TALAYAN	-	-	-	-	987	95	11	394	338	704	1,353	872	-	-	-	-	4,753
TALITAY	-	-	-	-	925	-	-	-	-	-	257	-	-	-	-	-	1,182
UPI	-	-	-	-	3,389	1,621	97	263	1,014	2,291	1,614	4,636	-	-	-	-	14,925
Total Area (Ha)	-	-	-	-	49,845	20,934	1,563	5,413	10,102	16,180	50,350	17,019	-	-	-	-	**171,405**

Note: Delivery of cacao planting materials must be started on the onset of rainy season.
**establishment of shade trees prior to planting of cacao.*

SUITABILITY CLASSES:

Highly Suitable (S1)
Land having no significant limitation to sustained application of a given use, or only minor limitations that will not significantly reduce productivity or benefits and will not raise inputs above an acceptable level.

Marginally Suitable (S3)
Land having limitations which in aggregate are severe for sustained application of a given use and will so reduce productivity or benefits, or increase required inputs, that this expenditure will be only marginally justified.

Moderately Suitable (S2)
Land having limitation which in aggregate are moderately severe for sustained application of a given use; the limitation will reduce productivity or benefits and increase required inputs to the extent that the overall advantage to be gained from the use, although still attractive, will be appreciably inferior to that expected on class S1 land.

Not Suitable / Not Relevant
Land having limitations which may be surmountable in time but which cannot be corrected with existing knowledge at currently acceptable cost; the limitations are so severe as to preclude successful sustained use of the land in the given manner. Existing forest, shrubland greater than 18% slope, irrigated paddy rice and miscellaneous land types such as built up areas, roads, etc are considered as not relevant.

CLIMATE TYPE

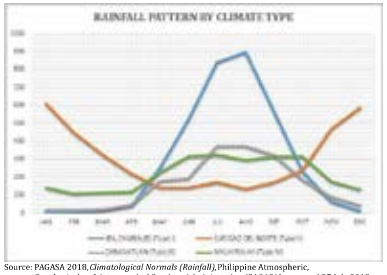
TYPE I : Two pronouced season, dry from November to April and wet during the rest of the year, Maximum rain period is from June to September

TYPE II : No dry season with a very pronounced maximum rain period from December to February. There is not a single dry month, Maximum monthly rainfall occurs during the period from March to May.

TYPE III : No very pronounced maximum rain period, with a dry season lasting only from one to three months, either during the period from December to February or from March to May. This type resembles Type I since it has a short dry season.

TYPE IV : Rainfall is more or less evenly distributed throughout the year, This type resembles Type II since it has no dry season.

Western part of Maguindanao is classified as climate Type IV and Eastern part is Type III.



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CODE	LANDUSE
2	Paddy rice, non-irrigated
4	Corn
116	Coconut
126	Grassland, unmanaged
134	Shrubs, unmanaged
144	Falcata

AGRONOMIC REQUIREMENT OF CACAO PRODUCTION

LAND UTILIZATION TYPE	SUITABILITY RATING	SLOPE (%)	SOIL DEPTH (cm)	SOIL TEXTURE	SOIL DRAINAGE	SOIL REACTION (pH)	INHERENT FERTILITY	FLOODING CLASS	EROSION CLASS	ROCK OUTCROPS	ELEVATION (masl)	ANNUAL RAINFALL (mm)	CLIMATIC TYPE
Cacao	S1	<8	>100	CL, SiCL, SCL, SC, SiC, C, HC	WD,MWD	5.6 -7.2	high	none-slight	none-slight	none-few	<1000	2001-4500	I, III, IV
	S2	8 - 30	50 - 100	FSL, L, SiL	SPD,PD	5.1 - 5.5 7.3 - 7.8	medium	moderate	moderate	common	1000-1500	1000-2000	I, II
	S3	>30	<50	S, LS, CSL, SL	VPD,ED	<5.0 - > 7.9	low	severe	severe	many	>1500	<1000 >4500	

SLOPE (%)
0 - 3 - level to gently sloping
3 - 8 - gently sloping to undulating
8 - 18 - undulating to rolling
18 - 30 - rolling to moderately steep
30 - 50 - steep
> 50 - very steep

SOIL DRAINAGE
ED - excessively drained
WD - well drained
MWD - moderately well drained
SPD - somewhat poorly drained
PD - poorly drained
VPD - very poorly drained

SOIL REACTION (pH)
< 4.5 - extremely acid
4.5 - 5.0 - very strongly acid
5.1 - 5.5 - strongly acid
5.6 - 6.0 - medium acid
6.1 - 6.5 - slightly acid
6.6 - 7.2 - neutral
7.3 - 7.8 - mildly alkaline
7.9 - 8.4 - moderately alkaline
> 8.5 - strongly alkaline

SOIL TEXTURE
Coarse
S - sand
LS - loamy sand
CSL - coarse sandy loam
SL - sandy loam
Medium
FSL - fine sandy loam
L - loam
SiL - silt loam
CL - clay loam
SiCL - silty clay loam
SCL - sandy clay loam
Fine
SC - sandy clay
SiC - silty clay
C - clay
HC - heavy clay

SOIL DEPTH (cm)
0 - 30 - very shallow
30 - 50 - shallow
50 - 100 - moderately deep
> 100 - deep to very deep

SURFACE IMPEDIMENT
ROCK OUTCROPS
< 10% - none - few
10 - 30% - common
> 30% - many

LAND LIMITATIONS DESCRIPTION AND COMBINATIONS

ELEVATION
El2 - 1000m - 1500m
El3 - > 1500m

SOIL DRAINAGE
D2 - Somewhat poorly drained to poorly drained
D3 - Very poorly drained or excessively drained

SOIL DEPTH
Sh2 - Moderately deep (50 - 100cm)
Sh3 - Very shallow to shallow (< 50cm)

SOIL EROSION
E2 - Moderate erosion
E3 - Severe erosion

SLOPE/TOPOGRAPHY
T2 - Undulating to moderately steep
T3 - Steep to very steep

SOIL TEXTURE
Tc - Coarse texture

ROCK OUTCROPS
Rc2 - Common
Rc3 - Many

FLOODING
F2 - Moderate seasonal flooding
F3 - Severe seasonal flooding

CODE	LIMITATION	CODE	LIMITATION	CODE	LIMITATION	CODE	LIMITATION	CODE	LIMITATION
1	E2-Sh2-Rc2	11	F3-D2	21	T2-El2-E3	31	T3-E3-Sh2-Rc3	41	T3
2	El2	12	Sh2	22	T2-El2-E3-Sh2-Rc2	32	T3-E3-Sh3-Rc2	42	T3-E3
3	El2-E2-Sh2-Rc3	13	Sh2-Rc2	23	T2-El2-E3-Sh2-Rc3	33	T3-E3-Sh3-Rc3	43	T3-E3-Rc3
4	El2-E3-Sh2-Rc3	14	T2	24	T2-El3-E3-Sh2-Rc2	34	T3-El2	44	T3-E3-Sh3-Rc3
5	El2-Sh2-Rc2	15	T2-E3	25	T2-El3-E3-Sh2-Rc3	35	T3-El2-E3	45	T3-El2
6	El2-Sh2-Rc3	16	T2-E3-Rc2	26	T2-F2-D2	36	T3-El2-E3-Sh3-Rc2	46	T3-El2-E3
7	El3	17	T2-E3-Rc3	27	T2-F3-D2	37	T3-El2-E3-Sh3-Rc3	47	T3-El2-E3-Sh3-Rc3
8	El3-Sh2-Rc2	18	T2-E3-Sh2-Rc2	28	T3	38	T3-El3-E3-Sh3-Rc2	48	T3-El3-E3-Sh3-Rc3
9	F2-D2	19	T2-E3-Sh2-Rc3	29	T3-E3	39	T3-El3-E3-Sh3-Rc3	49	T3-El3
10	F2-Tc	20	T2-El2	30	T3-E3-Rc2	40	T3-F3-D2		

LAND SUITABILITY MAP FOR CACAO

LAND RESOURCES EVALUATION AND SUITABILITY ASSESSMENT OF STRATEGIC PRODUCTION AREAS

PROVINCE OF SULU, ARMM

EXTENT OF SUITABILITY FOR CACAO PRODUCTION BY MUNICIPALITY

MUNICIPALITY	EXISTING CACAO (Ha)			TOTAL EXISTING AREA (Ha)	EXPANSION AREA (Ha)						CONFLICT RESOLUTION (Ha)						TOTAL POTENTIAL EXPANSION AREA (Ha)
					Coconut		Shrubland, unmanaged*		Grassland, unmanaged*		Corn		Paddy rice, non-irrigated		Other crops		
	S1	S2	S3		S1	S2	S1	S2	S1	S2	S1	S2	S1	S2	S1	S2	
HADJI PANGLIMA TAHIL	-	-	-	-	-	-	-	-	64	-	-	-	-	-	-	-	64
INDANAN	-	-	-	-	6,447	-	6	-	860	-	146	-	-	-	-	-	7,459
IOLO	-	-	-	-	11	-	-	-	-	-	-	-	-	-	-	-	11
KALINGALAN CALUANG	-	-	-	-	3,565	-	-	-	1,846	-	-	-	-	-	-	-	5,411
LUGUS	-	-	-	-	1,666	-	-	-	1,112	-	-	-	-	-	-	-	2,779
LUUK	-	-	-	-	3,444	-	-	-	3,483	-	-	-	-	-	-	-	6,928
MAIMBUNG	-	-	-	-	2,863	-	-	-	287	-	912	-	-	-	-	-	4,062
OLD PANAMAO	-	-	-	-	3,720	-	31	-	1,422	-	533	-	-	-	-	-	5,706
OMAR	-	-	-	-	2,547	-	953	-	2,202	-	143	-	-	-	-	-	5,844
PANDAMI	-	-	-	-	1,964	-	-	-	410	-	-	-	-	-	-	-	2,374
PANGLIMA ESTINO	-	-	-	-	935	-	12	-	448	-	850	-	-	-	-	-	2,245
PANGUTARAN	-	-	-	-	9,085	-	-	-	-	-	-	-	-	-	-	-	9,085
PARANG	-	-	-	-	5,704	-	-	-	43	-	367	-	-	-	-	-	6,114
PATA	-	-	-	-	1,738	-	-	-	2,342	-	-	-	-	-	-	-	4,080
PATIKUL	-	-	-	-	7,494	-	121	-	2,380	-	498	-	-	-	-	-	10,493
SIASI	-	-	-	-	4,137	-	-	-	1,537	-	-	-	-	-	-	-	5,675
TALIPAO	-	-	-	-	8,905	-	54	5	1,521	-	4,409	-	-	-	-	-	14,892
TAPUL	-	-	-	-	980	-	-	-	838	-	-	-	-	-	-	-	1,818
TONGKIL	-	-	-	-	656	-	140	-	26	-	52	-	-	-	-	-	873
Total Area (Ha)	-	-	-	-	65,860	-	1,317	5	20,821	-	7,909	-	-	-	-	-	**95,912**

Note: Delivery of cacao planting materials must be started on the onset of rainy season.
**establishment of shade trees prior to planting of cacao.*

AGRONOMIC REQUIREMENT OF CACAO PRODUCTION

LAND UTILIZATION TYPE	SUITABILITY RATING	SLOPE (%)	SOIL DEPTH (cm)	SOIL TEXTURE	SOIL DRAINAGE	SOIL REACTION (pH)	INHERENT FERTILITY	FLOODING CLASS	EROSION CLASS	ROCK OUTCROPS	ELEVATION (masl)	ANNUAL RAINFALL (mm)	CLIMATIC TYPE
Cacao	S1	<8	>100	CL, SiCL, SCL, SC, SiC, C, HC	WD,MWD	5.6 -7.2	high	none-slight	none-slight	none-few	<1000	2001-4500	I, III, IV
	S2	8 - 30	50 - 100	FSL, L, SiL	SPD,PD	5.1 - 5.5 7.3 - 7.8	medium	moderate	moderate	common	1000-1500	1000-2000	I, II
	S3	>30	<50	S, LS, CSL, SL	VPD,ED	<5.0 - > 7.9	low	severe	severe	many	>1500	<1000 >4500	

SLOPE (%)
0 - 3 - level to gently sloping
3 - 8 - gently sloping to undulating
8 - 18 - undulating to rolling
18 - 30 - rolling to moderately steep
30 - 50 - steep
> 50 - very steep

SOIL DEPTH (cm)
0 - 30 - very shallow
30 - 50 - shallow
50 - 100 - moderately deep
> 100 - deep to very deep

SOIL DRAINAGE
ED - excessively drained
WD - well drained
MWD - moderately well drained
SPD - somewhat poorly drained
PD - poorly drained
VPD - very poorly drained

SURFACE IMPEDIMENT
ROCK OUTCROPS
< 10% - none - few
10 - 30% - common
> 30% - many

SOIL REACTION (pH)
< 4.5 - extremely acid
4.5 - 5.0 - very strongly acid
5.1 - 5.5 - strongly acid
5.6 - 6.0 - medium acid
6.1 - 6.5 - slightly acid
6.6 - 7.2 - neutral
7.3 - 7.8 - mildly alkaline
7.9 - 8.4 - moderately alkaline
> 8.5 - strongly alkaline

SOIL TEXTURE
Coarse
S - sand
LS - loamy sand
CSL - coarse sandy loam
SL - sandy loam
Medium
FSL - fine sandy loam
L - loam
SiL - silt loam
CL - clay loam
SiCL - silty clay loam
SCL - sandy clay loam
Fine
SC - sandy clay
SiC - silty clay
C - clay
HC - heavy clay

LAND LIMITATIONS DESCRIPTION AND COMBINATIONS

ELEVATION
El2 - 1000m - 1500m
El3 - > 1500m

SLOPE/TOPOGRAPHY
T2 - Undulating to moderately steep
T3 - Steep to very steep

SOIL DRAINAGE
D2 - Somewhat poorly drained to poorly drained
D3 - Very poorly drained or excessively drained

SOIL TEXTURE
Tc - Coarse texture

SOIL DEPTH
Sh2 - Moderately deep (50 - 100cm)
Sh3 - Very shallow to shallow (< 50cm)

ROCK OUTCROPS
Rc2 - Common
Rc3 - Many

SOIL EROSION
E2 - Moderate erosion
E3 - Severe erosion

FLOODING
F2 - Moderate seasonal flooding
F3 - Severe seasonal flooding

CODE	LIMITATION	CODE	LIMITATION
1	El2-Sh2-Rc2	11	T3-E3-Sh3-Rc2
2	F2-Tc	12	T3-El2-F3-Sh3-Rc2
3	F3-D2	13	T3-F3-D2
4	T2	14	T3
5	T2-E3	15	T3-E3
6	T2-E3-Sh2-Rc2	16	T3-E3-Sh3-Rc3
7	T2-El2-E3-Sh2-Rc2	17	T3-El2-E3-Sh3-Rc3
8	T2-F3-D2	18	T3-El3
9	T3	19	Tc
10	T3-E3		

CODE	LANDUSE
2	Paddy rice, non-irrigated
4	Corn
82	Cacao
116	Coconut
126	Grassland, unmanaged
134	Shrubs, unmanaged

SUITABILITY CLASSES:

Highly Suitable (S1)
Land having no significant limitation to sustained application of a given use, or only minor limitations that will not significantly reduce productivity or benefits and will not raise inputs above an acceptable level.

Moderately Suitable (S2)
Land having limitation which in aggregate are moderately severe for sustained application of a given use; the limitation will reduce productivity or benefits and increase required inputs to the extent that the overall advantage to be gained from the use, although still attractive, will be appreciably inferior to that expected on class S1 land.

Marginally Suitable (S3)
Land having limitations which in aggregate are severe for sustained application of a given use and will so reduce productivity or benefits, or increase required inputs, that this expenditure will be only marginally justified.

Not Suitable / Not Relevant
Land having limitations which may be surmountable in time but which cannot be corrected with existing knowledge at currently acceptable cost; the limitations are so severe as to preclude successful sustained use of the land in the given manner. Existing forest, shrubland greater than 18% slope, irrigated paddy rice and miscellaneous land types such as built up areas, roads, etc are considered as not relevant.

CLIMATE TYPE

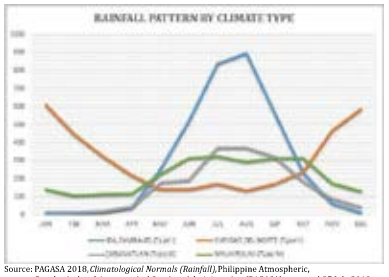
TYPE I : Two pronouced season, dry from November to April and wet during the rest of the year. Maximum rain period is from June to September

TYPE II : No dry season with a very pronounced maximum rain period from December to February. There is not a single dry month. Maximum monthly rainfall occurs during the period from March to May.

TYPE III : No very pronounced maximum rain period, with a dry season lasting only from one to three months, either during the period from December to February or from March to May. This type resembles Type I since it has a short dry season.

TYPE IV : Rainfall is more or less evenly distributed throughout the year. This type resembles Type II since it has no dry season.

Province of Sulu is classified as climate type IV



Source: PAGASA 2018. *Climatological Normals (Rainfall)*. Philippine Atmospheric, Geophysical and Astronomical Services Administration (PAGASA), accessed 27 July 2018, <https://www1.pagasa.dost.gov.ph/index.php/climate/climatological-normals>.

LAND SUITABILITY MAP FOR CACAO

LAND RESOURCES EVALUATION AND SUITABILITY ASSESSMENT OF STRATEGIC PRODUCTION AREAS

PROVINCE OF TAWI-TAWI, ARMM

EXTENT OF SUITABILITY FOR CACAO PRODUCTION BY MUNICIPALITY

MUNICIPALITY	EXISTING CACAO (Ha)			TOTAL EXISTING AREA (Ha)	EXPANSION AREA (Ha)						CONFLICT RESOLUTION (Ha)						TOTAL POTENTIAL EXPANSION AREA (Ha)
					Coconut		Shrubland, unmanaged*		Grassland, unmanaged*		Corn		Paddy rice, non-irrigated		Other crops		
	S1	S2	S3		S1	S2	S1	S2	S1	S2	S1	S2	S1	S2	S1	S2	
BONGAO	-	-	-	-	3,356	2,123	345	2	19	-	12	-	-	-	-	-	5,857
LANGUYAN	-	-	-	-	75	1,538	4	776	8	336	-	51	-	-	-	-	2,789
MAPUN	-	-	-	-	4,745	863	-	-	-	-	-	-	-	-	-	-	5,607
PANGLIMA SUGALA	-	-	-	-	1,882	1,156	212	966	50	-	-	-	-	-	-	-	4,266
SAPA-SAPA	-	-	-	-	2,992	-	943	8	57	-	38	-	-	-	-	-	4,038
SIBUTU	-	-	-	-	544	-	4,526	34	720	-	1,004	2	-	-	-	-	6,831
SIMUNUL	-	-	-	-	3,659	-	1,840	-	21	-	-	-	-	-	-	-	5,520
SITANGKAI	-	-	-	-	1,359	-	287	-	521	-	-	-	-	-	-	-	2,167
SOUTH UBIAN	-	-	-	-	1,673	-	224	-	2	-	-	-	-	-	-	-	1,900
TANDUBAS	-	-	-	-	1,820	6	2,109	1,089	1,240	6	-	-	-	-	-	-	6,270
Total Area (Ha)	-	-	-	-	22,106	5,685	10,490	2,867	2,640	342	1,059	53					45,237

Note: Delivery of cacao planting materials must be started on the onset of rainy season.
**establishment of shade trees prior to planting of cacao.*

AGRONOMIC REQUIREMENT OF CACAO PRODUCTION

LAND UTILIZATION TYPE	SUITABILITY RATING	SLOPE (%)	SOIL DEPTH (cm)	SOIL TEXTURE	SOIL DRAINAGE	SOIL REACTION (pH)	INHERENT FERTILITY	FLOODING CLASS	EROSION CLASS	ROCK OUTCROPS	ELEVATION (masl)	ANNUAL RAINFALL (mm)	CLIMATIC TYPE
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	S2	8 - 30	50 - 100	FSL, L, SiL	SPD,PD	5,1 - 5,5 7,3 - 7,8	medium	moderate	moderate	common	1000-1500	1000-2000	I, II
	S3	>30	<50	S, LS, CSL, SL	VPD,ED	<5,0 - > 7,9	low	severe	severe	many	>1500	<1000 >4500	

SLOPE (%)
0 - 3 - level to gently sloping
3 - 8 - gently sloping to undulating
8 - 18 - undulating to rolling
18 - 30 - rolling to moderately steep
30 - 50 - steep
> 50 - very steep

SOIL DEPTH (cm)
0 - 30 - very shallow
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ED - excessively drained
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SCL - sandy clay loam
Fine
SC - sandy clay
SiC - silty clay
C - clay
HC - heavy clay

LAND LIMITATIONS DESCRIPTION AND COMBINATIONS

ELEVATION
EI2 - 1000m - 1500m
EI3 - > 1500m

SLOPE/TOPOGRAPHY
T2 - Undulating to moderately steep
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SOIL DRAINAGE
D2 - Somewhat poorly drained to poorly drained
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Rc2 - Common
Rc3 - Many

SOIL EROSION
E2 - Moderate erosion
E3 - Severe erosion

FLOODING
F2 - Moderate seasonal flooding
F3 - Severe seasonal flooding

CODE	LIMITATION	CODE	LIMITATION	CODE	LIMITATION
1	E2-Sh2-Rc2	11	T2-F3-D2	21	T3-E3
2	F2-D2	12	T3	22	T3-E3-Rc3
3	F3-D2	13	T3-E3	23	T3-E3-Sh3-Rc3
4	Sh2-Rc2	14	T3-E3-Rc2	24	T3-EI2-E3-Sh3-Rc3
5	T2	15	T3-E3-Sh2-Rc3	25	T3-F3-D2
6	T2-E3	16	T3-E3-Sh3-Rc2	26	T3-EI3
7	T2-E3-Rc2	17	T3-E3-Sh3-Rc3	27	Tc
8	T2-E3-Rc3	18	T3-EI2-E3-Sh3-Rc2		
9	T2-E3-Sh2-Rc2	19	T3-F3-D2		
10	T2-E3-Sh2-Rc3	20	T3		

CODE	LANDUSE
2	Paddy rice, non-irrigated
4	Corn
82	Cacao
116	Coconut
126	Grassland, unmanaged
134	Shrubs, unmanaged

SUITABILITY CLASSES:

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Land having limitation which in aggregate are moderately severe for sustained application of a given use; the limitation will reduce productivity or benefits and increase required inputs to the extent that the overall advantage to be gained from the use, although still attractive, will be appreciably inferior to that expected on class S1 land.

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Land having limitations which may be surmountable in time but which cannot be corrected with existing knowledge at currently acceptable cost; the limitations are so severe as to preclude successful sustained use of the land in the given manner, Existing forest, shrubland greater than 18% slope, irrigated paddy rice and miscellaneous land types such as built up areas, roads, etc are considered as not relevant.

CLIMATE TYPE

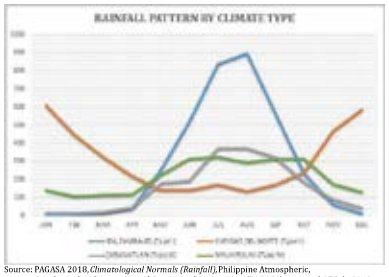
TYPE I : Two pronouced season, dry from November to April and wet during the rest of the year. Maximum rain period is from June to September

TYPE II : No dry season with a very pronounced maximum rain period from December to February. There is not a single dry month, Maximum monthly rainfall occurs during the period from March to May.

TYPE III : No very pronounced maximum rain period, with a dry season lasting only from one to three months, either during the period from December to February or from March to May, This type resembles Type I since it has a short dry season.

TYPE IV : Rainfall is more or less evenly distributed throughout the year. This type resembles Type II since it has no dry season.

Tawa-tawi is classified as climate type IV



Source: PAGASA 2018, *Climatological Normals (Rainfall)*, Philippine Atmospheric, Geophysical and Astronomical Services Administration (PAGASA), accessed 27 July 2018, <https://www1.pagasa.dost.gov.ph/index.php/climate/climatological-normals>.

APPENDIX 4. DIRECTORY OF THE PHILIPPINE CACAO INDUSTRY COUNCIL

Membership	Representative	Designation	Contact Details
Chairperson:			
Armson Corporation	Consul Armi Lopez Garcia	Director	09173222764 armilopezgarcia@yahoo.com
Co-Chairperson:			
Department of Agriculture	USec. Evelyn Laviña	Undersecretary	(02) 8 926 8444 agri.hvc.da@gmail.com
Vice-Chair (Private Sector):			
- Luzon Island	Sylvia Ordoñez	Chairperson, R3-Central Luzon	09178403711; sylviaordonez@gmail.com
- Visayas Island	Buen Mondejar	Chairperson, R6-Western Visayas	09998803022; buenmondejar@gmail.com
- Mindanao Island	Christopher H. Lindo	Chairperson, R13-CARAGA	09177060600; chrizlindo24@gmail.com
Vice-Chair (Gov't Sector):			
Department of Trade and Industry	USec. Blesila A. Lantayona	Undersecretary	(02) 751 3335 rog@dti.gov.ph
Value Chain Cluster Representative:			
- Trader/Export	Simon Bakker	CEO, Kennemer Foods International	simon.bakker@kennemerfoods.com
- Nursery	Charita Puentespina	Proprietor, Malagos AgriVenture Corp.	charitap1939@gmail.com 09176327686
- Production	Cristopher Fadriga	Farmer	chrisfadriga1958@gmail.com; 09565919071
- Processing	Auro Chocolate	Kelly Go, Managing Director	k.go@aurochocolate.com
Secretariat:			
Department of Trade and Industry	Romeo L. Castañaga	DTI-NICC for Cacao	RomeoCastanaga@dti.gov.ph

Membership	Representative	Designation	Contact Details
Government Sector:			
Mindanao Dev't Authority	Atty. Nathaniel D. Dalumpines	OIC-Chairperson	(082) 221 8109
			info@minda.gov.ph; officeofthechairman@minda.gov.ph; ernie.tomas@minda.gov.ph
Dept. of Science and Technology	Dir. Leila C. America, PhD	Director., DOST PCAARRD	(049) 521 8564
			leila_america@yahoo.com; tinbar16@yahoo.com
Philippine Coconut Authority	Dennis Andres	Manager of Operations Dept.	(02) 928 4501 loc. 509 / Fax no. (02) 926 7631
			pca_ofad@yahoo.com; ofad@pca.gov.ph; admin@pca.gov.ph
Dept. of Environment and Natural Resources	Nonito M. Tamayo, Ceso IV	Director	(02) 920-6215; 927-4788; 925-2139
			mbdenr@mozcom.com; jiniayaneza@yahoo.com
Dept. of Agrarian Reform	Usec. Emily Padilla	Undersecretary	(02) 426-7484
			dar.gov.ph@gmail.com; usec.sso@dar.gov.ph
Land Bank of the Philippines	Edgardo S. Luzano	Dept. Head , LBP	(02) 405-7450; 405-7309
Small Business Corporation	Ma. Luna E. Cacanando	President & CEO	(02) 751 1888 / (02) 813 5720
			mlunacacanando@sbgfc.org.ph; fgonzaga@mail.sbgfc.org.ph
Private Sector:			
REGIONAL CACAO COUNCIL	Victorino B. Barona Jr.	CAR	09159340038
			vbbaronajr@gmail.com; vbbarona@gmail.com
	Atty. Robert B. Tudayan	R1-Ilocos Region	09163712021
			tudayanattyrobert@yahoo.com
	Pepito Dizon	R2-Cagayan Valley	09194891899
			pdizonjr2017@yahoo.com
	Sylvia Ordonez	R3-Central Luzon	09178403711
			sylvia.ordonez@gmail.com

Membership	Representative	Designation	Contact Details
	Florencio A. Flores	R4A-CALABARZON	09989800477
			florencio.a.flores@gmail.com
	Bernardo F. Sampayan	R4B-MIMAROPA	09175414945
			bern_fsampayan@yahoo.com
	Eduardo R. Pilapil Jr	R5-Bicol Region	09175014000
			edpilapil@gmail.com
	Buen Mondejar	R6-Western Visayas	09998803022
			c/o andreareyes@dti.gov.ph
	Consul Armi Lopez Garcia	R7-Central Visayas	09173222764
			armilopezgarcia@yahoo.com
	Isidro Estrerra	R8-Eastern Visayas	09166204648
			c/o bdd.dti8@gmail.com
	Louie Nova	R9-Zamboanga Peninsula	09459610336
			jasagriventureszc@gmail.com
	Agustin Mercado, Jr.	R10-Northern Mindanao	09179843780
			agustin_mercado@yahoo.com
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