



The  
**Food and Land Use  
Coalition**



# Summary of Food and Land Use Study (FOLU)

## In West Papua Province



WORLD  
RESOURCES  
INSTITUTE



# 03

**FOOD SECURITY**

# 11

**AQUACULTURE**

# 16

**ECOTOURISM**

# 21

**BIBLIOGRAPHY**

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# FOOD SECURITY

## SUMMARY OF FOOD SECURITY STUDIES IN WEST PAPUA

**Food security** is an obligation for the fulfilment of food from the state to the individual, reflected in the availability of sufficient food, both in quantity and quality. Food must be safe, diverse, nutritious, equitable, and affordable without conflicting with the religion, beliefs, and culture of the community. The food must allow communities to lead healthy, active, and productive lives in a sustainable manner (Ministry of Agriculture, 2018).

The Food Security Index (IKP) is intended to measure food availability, affordability, and utilization using 9 indicators. West Papua's IKP ranges from 26.03 to 61.41. 6 districts in West Papua have an IKP below 41.52, meaning they have high vulnerability (priority 1): Tambrauw, Arfak Mountains, Maybrat, Wondama Bay, Bintuni Bay, and Fakfak.

The purpose of this study is to conduct an analysis of food security and nutrition to create a basis to make recommendations to local governments about mapping sustainable food and land use (FOLU). Data collection was carried out from January – April 2019 through primary data collection (in-depth interviews, group interviews at workshops, focus group discussions, market surveys, observations) and secondary data (literature study, secondary data analysis). The summary is divided into four sections according to the discussion in the report: Food use, food access, food availability, and governance.



## Nutritional Status and Food Security of West Papua

- One in three (33%) children under the age of five in West Papua are stunted (short for their age). This condition is already at a high level of severity, being the most acute in South Sorong and Tambrau.
- One in two (44%) women suffer from chronic energy deficient or have experienced malnutrition for a long period of time. If a pregnant woman is malnourished, there is a significant risk of giving birth to a child with a low birth weight — a body weight of less than 2500 grams with a body length below 48 centimeters — passing malnutrition down through generations. Currently, the prevalence of low body weight is 11% while short body length is 19%.
- In addition to malnutrition, West Papua is also faced with the issue of over-nutrition. 8% of infants, 12% of adolescents aged 16-18 years old, and 26% of adults are over-nourished. Children who are overweight tend to remain overweight as adults, and over-nutrition is strongly correlated with various non-communicable diseases in old age such as diabetes, heart disease, and cancer.

## KONSUMSI PANGAN DI PAPUA BARAT

- SUSENAS (2017) data shows that on average West Papua's fulfillment of energy consumption is good (96.9%) but this is not evenly distributed among the districts. In some rural areas in West Papua the levels of protein consumption are still below 90% (Fakfak, Kaimana, Tambrau, Maybrat, Arfak Mountains) while there are other areas where energy consumption reaches 140%, namely the urban area of South Manokwari.
- The energy contribution from high calorie snacks compared to energy from the consumption of sago (a staple food of the indigenous people of West Papua), is cause for concern. Energy from high calorie snacks in the city of South Manokwari reaches 460 kcal / cap / day, while rural South Sorong is 218 kcal / cap / day. Both of these areas have fulfillment of energy consumption above 110%.
- Judging by the high consumption of alternative staple foods (other than rice and flour) and alternative meats (other than ruminants and poultry), rural areas in South Manokwari, Kaimana, Maybrat, rural Bintuni Bay, Tambrau, Wondama Bay, and the Arfak mountains have a food system that is still very traditional compared to other parts of West Papua.
- According to SUSENAS (2017), in districts with an energy intake below 90%, the majority of carbohydrates come from rice, sago, tubers, and flour. In the villages of the Arfak Mountains, Tambrau, and Kaimana, sago is the cheapest carbohydrate in terms of price per calorie. The lowest diversity of carbohydrate sources is in the Arfak Mountains. However, the average price of energy from food sources of carbohydrates in the Arfak Mountains is also the cheapest.

## 6 Food Security

- Growing rice consumption in West Papua is very dependent on imports from external sources. Only Sorong, Manokwari, and South Manokwari have sufficient rice production to meet local demand. However, sago consumption does not rely on external supplies at all. Sago production in South Sorong is extremely high compared to local demand, and surpluses can be supplied to other districts. On average, sago consumption in rural communities in West Papua is far higher than the nutritional adequacy set by national figures. Low consumption of sago in urban areas (excluding Bintuni Bay) must be considered. Sago is a staple food widely consumed in coastal communities, while cassava is a staple food of mountain communities (primarily in Arfak).
- Most protein consumption in West Papua comes in the form of rice, fish, other fresh aquatic animals, and alternative meat. On average, the protein intake of people in West Papua is quite good (57.5 – 62 grams / day in urban areas and 55 grams / day in rural areas). However, like energy consumption, protein intake is unevenly distributed. Areas that consume below 90% of protein needs are Tambrau (83.6%), Maybrat (82.6%), and the Arfak Mountains (61.5%). Regions with a per capita protein intake that exceeds 110% are rural and urban Bintuni Bay (112% and 117% respectively), urban Manokwari (114%), Raja Ampat (111%) and urban South Manokwari (167%).
- The area with the lowest protein consumption, the Arfak Mountains, does not seem to get protein from any significant food source beyond rice. Fish and aquatic animals are good sources of protein in coastal areas, however surplus provincial proteins can also be sent to other regions
- Based on SDT data from 2014, the groups most prone to low protein intake are 13-18 year olds and >55 year olds of both genders in rural West Papua. Groups most prone to consuming excess protein are girls aged 5-12 years in rural areas and 5-12 year olds of both genders, adults aged 19-55, and elderly women in urban areas.
- In districts whose protein intake is less than 90%, the cheapest protein source is non- animal protein, specifically peanuts. In Tambrau and Maybrat, cheap protein sources are dominated by vegetable and fish proteins. In the Arfak Mountains, alternative meat is the second cheapest after peanuts. The Arfak Mountains have the lowest diversity of protein intake. Tambrau, a coastal district, has the most varied protein sources with the lowest average price per gram of protein. Animal protein is superior in quality than vegetable protein, due to its completeness and balance of amino acids and better digestibility. However, balanced consumption of plant and animal protein is important to avoid the health consequences of eating too much meat.
- The changes in food consumption in cities and villages from 2008-2017 include increases in vitamin A-rich fruits, rice based staple foods, preserved fish and aquatic animals, ready-to-consume water, other vegetables, animal organs, oils and fats, non-alcoholic calorie drinks, fresh poultry meat, eggs, and high calorie snacks. Foods whose consumption decreased over this time period include sugar, salt, alternative staple foods, other fruits, alternative meats, legumes and green vegetables. Types of foods whose consumption grew in urban areas but fell in rural areas are preserved meat, prepared meat, and rum. Foodstuffs that were consumed more in rural areas and less in urban areas were flour based foods, processed nuts, seasonings, vegetables rich in vitamin A, milk and milk products, crackers, and alcohol.
- Feeding and parenting practices for newborn children are a significant issue. Initiation of Early Breastfeeding in the first hour after birth is only done by 1 in 5 mothers (22%) but the administration

of colostrum (the first breast milk that comes out yellow due to immunity boosting substances) is practiced by many mothers (85%). The practice of giving food other than breast milk in infants less than 6 months old is still performed by 1 in 3 (36%) mothers. The average breastfeeding time is only 10 months out of the recommended 24 months.

- The diets of children aged 6-23 months old are not diverse (less than 4 types of food). Most children aged 3 years and older consume sweet foods (high in sugar), fatty/fried foods, burnt foods, and instant noodles almost every day (1-6 times per week) and sweet drinks more than 1 time per day. One in two residents (56%) aged 5 years and over consume only 1-2 servings of fruit and vegetables per day (out of 5 recommended servings).



**KETERSEDIAAN PANGAN DI PAPUA BARAT**

- Food in West Papua is both locally and externally. Food from outside West Papua (From East Java, South Sulawesi, and North Sulawesi) makes up more than 80% of the food consumed in Papua. Cassava, sago, fish, and several local fruits and vegetables are the only foods whose demands are satisfied by local production.
- Taking the nutritional adequacy rate into account, food availability in some districts is still deficient. Most often, the carbohydrate that is produced locally in a district is the type of food there are shortages of. In Fakfak, Kaimana, Bintuni Bay, the Arfak mountains, Manokwari, South Sorong, Raja Ampat, South Manokwari, and Sorong City all face cassava food deficits. The regencies of Fakfak, Kaimana, Bintuni Bay, South Sorong, South Manokwari and Sorong City have deficits of sweet potatoes. As for sago, deficits occur everywhere except South Sorong, Sorong, Wondama Bay, and Bintuni Bay where the vast majority of sago is produced and surplus is sent to other districts.
- Rice supply from outside West Papua (South Sulawesi and East Java) to West Papua does not only meet commercial needs, civil servants, and military/police consumption. It also meets the needs of the poor, as all districts in West Papua receive rice.
- Food is available in traditional markets in West Papua in varied quantities and types. Sago flour is only available in certain places and in relatively small quantities due to the difficulty of reaching the heart of the sago palm.
- The area of land used for food production with shifting cultivation systems in West Papua is around 662,818 hectares while land using the garden system covers about 6,523 hectares. Temporary uncultivated land takes up about 2,087,099 hectares. South Sorong regency is the largest in terms of temporary land not being cultivated at 1,147,949 hectares. The area of land for rice production consists of 7,501 hectares of irrigated paddy land and 12,160 hectares of non-irrigated paddy land for a total of 19,661 hectares. Manokwari and Sorong districts have the largest area of paddy fields in West Papua. Based on harvested area, rice plants occupy the most area, followed by cassava and sweet potato. Though the area of land for cassava crops is much broader, the existing irrigated rice fields are almost entirely cultivated with a good average yield (4.2 tons of milled dry grain/hectare)
- For West Papua to reach self-sufficiency in rice production, 16,186 hectares of rice fields were required in 2017 and an additional 1000 hectares will be needed by 2022 (about 17,987 hectares in total). To become independent in soybean production, West Papua needs 3,792 hectares of soybean fields by 2022. Cassava and sweet potato plants have a relatively small increase in land requirements, needing an increase in area of 1,001 and 506 hectares respectively.
- Agricultural land conversion poses a serious threat to food supply, security, and conservation in West Papua, especially the large-scale conversion of land into settlements and large plantations. Land dedicated to plantations has increased by 81.63%, from 29,783.37 hectares in 2009 to 54,096.68 hectares in 2017. Land use for the residential sector increased by 17.20%, from 16,358.90 hectares in 2009 to 38,864.73 hectares in 2017.
- Water resources to support wider scale food production in West Papua are quite abundant. Rainfall alone can support a large amount of food production as there is no specific dry season in West Papua. Surface water can also be sourced widely from weirs, which are mostly tyrol system weirs in West Papua due of the heavy flow

of the rivers. In the tyrol system, the river is dammed to raise the water level to a point that minimum discharge conditions can send water through an irrigation network. However, the efficiency of this water use is still fairly low.

- Climate change is a serious global threat to agricultural production and food security. Climate change has a direct impact on changing climate parameters and increasing the intensity of extreme climate events (El Niño and La Niña), often leading to flood damage and huge economic losses. Geographically, Papua is very sensitive in relation to the extreme climates of the Pacific region. Every change in SST above below 0.5 causes rainfall in Papua to deviate 10-30% away from normal conditions, directly impacting crops causing up to 50% of production to stagnate, especially rice.
- Food security and nutrition are basic needs for every human, and requires cooperation between multiple parties to achieve. Therefore, ideally, the food security program will be carried out in an integrated manner between various stakeholders so that the planning, implantation, and sustainability of its actions are in line with the target, namely in the context of realizing the expectations of the beneficiaries in accordance with the mandate of laws and government regulations on food security and nutrition.



### Access to Food by the People of West Papua

- Exposure of expenditure data from SUSENAS (2017) indicates that there is a disparity in expenditure between urban and rural areas, as rural households are much weaker. The regions with the most expenditure are Sorong City, Bintuni Bay and Manokwari. Households in the Arfak mountains, Tambrau, Maybrat, and Raja Ampat are indicated as economically weak households because the ratio of expenditure to food and total expenditure is greatest.
- Food access is not only influenced by income and food prices, but by humanitarian assistance and social security networks. The sources of village income in West Papua are primarily the village fund, the village's original income, local taxes and levies, the allocation of village funds, financial assistance from the provincial fund, financial assistance from the district/city funds, grants and donations from third parties, and other legitimate income. A total of 12 districts in West Papua receive village funds in an amount that continues to increase from year to year.
- Rice is a commodity that is managed carefully, but often experiences significant price fluctuations. In 2018, the price of rice varied from Rp 8,500 / kg to Rp 14,500 / kg. The highest prices are found in Fakfak, and the lowest in Manokwari. For premium rice, prices can reach Rp 16,000 / kg in Fakfak while the lowest price is Rp 10,000 / kg in Kaimana. Using the proportion of household expenditure for food as an indicator of purchasing power, in the regions of Fakfak, Raja Ampat, Tambrau, and Kaimana almost the entire region's food expenditure makes up 70% of total household expenditure. Only Sorong and Sorong City have proportions of household expenditure to food expenditure less than 50%. On average West Papua has a food expenditure of 65% of the total household expenditure

### Non-Food Factors that Affect Food Security

- Infectious disease such as tuberculosis (TB), malaria, dengue hemorrhagic fever (DHF), and diarrhea are prominent health problems. Acute respiratory infection (ARI) occurrence at all ages is 19%. Basic immunization coverage in infants is only completed 36% of the time. Three out of four people have contracted malaria. The incidence of diarrhea (watery bowel movements 3 times a day or more) in infants over the course of a month is 9%. Infection can cause malnutrition due to lack of food intake and poor digestive ability, making malnourished people more susceptible to infection.
- Non-communicable diseases in West Papua are still relatively rare. 2% of West Papuans aged 15 or above have diabetes, 1% suffer from heart disease, and hypertension in those 18 years or older occurs 8% of the time. The three districts with the highest prevalence of hypertension are Sorong City, Fakfak, and Manokwari. Risk factors related to smoking and lack of physical activity must also be taken into account, as one-fifth (22%) of the population aged 10 or above smoke every day, with an average of 15 cigarettes a day. Alcohol consumption in one month is about 8%, and 59% of the population aged 10 years or above did not do physical activity for the recommended 30 minutes a day.

- Sources of drinking water and adequate sanitation is a challenge in West Papua. Only half (55%) of households have a reliable source of safe drinking water. The average proportion of households that have access to defecation facilities classified as 'good' is only 55%. Seven districts that require more attention in terms of sanitation are Wondama Bay, Bintuni Bay, South Sorong, Sorong, Raja Ampat, Tambrauw, and Maybrat. The proportion of population aged 10 years and over who behave correctly in terms of washing hands — washing with soap before preparing food, after defecating, before handling children and babies, after coming into contact with animals and gardening, before breastfeeding, after using insecticide/ pesticide — is only 55%.
- Health services and demand for health services by the community need to be improved. The ideal ratio for general practitioners to residents is 30 per 100,000 people, and the current ratio of 26 per 100,000 people is close to reaching the target. The current ratio for nurses (157.8 per 100,000 people) is extremely close to reaching the goal of 158 nurses per 100,000 people. Numbers of midwives, public health, environmental health, and nutrition workers are still low in the Arfak Mountains, South Manokwari, Maybrat, and Tambrauw. 81% of deliveries were assisted by health workers, of which 63% were in health facilities (not home births). Pregnant women are recommended to go for four check-ups during pregnancy, however only half (48%) of women attended all four prenatal check ups. 28 day neonatal visits are only done by 13% of mothers and children. Monitoring the nutrition and health of pregnant women is an important step to maintain optimal children's health during the first 1,000 days of life.
- The role of the government is seen in the mandate of law No. 18 of 2018 and government regulation No. 83 of 2016. The juridical basis mandates provincial and district governments must be able to determine legal products in the form of regional regulations (Perda) and also mandates the establishment of the Food Security Council (DKP), whose functions are (a). to formulate policies in the framework of realizing provincial/district food security by taking into account policies set by the council, (b). formulating policies in order to encourage community participation in the implementation of food security measures, and (c). conducting evaluations and controlling the realization of provincial district food security.
- The West Papua Food Security Office has initiated the issuance of a Decree of the Governor of West Papua concerning the West Papua Food Security Council. However, this agency has not yet played a role as it is still in the stage of socialization. As such, the council has not yet formulated a policy and action plan for food security and nutrition in West Papua.
- The regional inflation control team (TPID) and the fresh food safety supervisory team are a form of integration in the supervision of OPD in West Papua. Integrated agencies in the TPID include the Food Security Agency, BPPM, the Industry and Trade Office, Kodam, and the police.
- The application of the role in the context of food security and nutrition by the relevant DPOs in West Papua is relatively one-sided and demand-driven, not supply-driven in the context of data requirements for analyzing the situation of food and nutrition security in West Papua. The Food Security Agency requests data assistance from relevant agencies, such as BPS, Quarantine, the Trade Office, the Health Office, agricultural services, fishery services, and livestock services.

### **Recommendation for the Implementation of Food Security in West Papua, as follows:**

- Create a program containing knowledge about the danger of excessive energy consumption, as the result of overconsuming food and drink with high amount of calories, mainly in urban areas in South Manokwari and rural areas in South Sorong.
- Create an educational program to observe food sources of the population in order to improving their energy fulfillment.
- Create a staple food conversion program from rice to sago and yam.
- Creating a program to improve both production and consumption of locally-sourced vegetables (particularly green vegetables) and fruits by the locals, and similarly successful program needs to be improved and expanded.
- Consumption of animal proteins must be increased in some areas which lacks of it.
- Alternative meat is the food biodiversity wealth of West Papua, and needs to be studied of its type, contribution, security and sustainability for consumption.
- Create a breeding center for inland fish, improving the potential for inland fisheries.
- Assist Department of Agriculture and Department of Trade to establish feed mill in Manokwari and Sorong.
- Assistance to improve productivities of freshwater fisheries at Arfak Mountains helps the consumption of animal proteins and increasing local fisherman's income.
- Improved access from and to Arfak Mountains helps increase food security of West Papua; increasing local vegetables and fruits consumption, and improving income of farmer at Arfak Mountains
- Set strict standards for food sources entering West Papua and apply policies to protect local consumers
- Access to BMKG's information monitors the possibilities of climate change which affects farmers.
- Utilization of organic material input improves continual productivity of sour land.
- Issues local regulations that strictly regulate the use of special farmland, and to limit land permit that convert premium land for farm use.
- Non-food factors that help creating high number of malnutrition in West Papua needs attention.

# Aquaculture

The development of the aquaculture sector in West Papua is supported by coastal areas that have good ecological potential, social aspects of the community, and high potential fisheries that must be managed sustainably. Marine biodiversity, a high density of reef fish, coral cover, and local wisdom must be maintained to sustain the economy in the future. The development of aquaculture in land areas and marine environments in West Papua are currently being, and will continue to be, developed. However, this activity has not been able to provide a large to activities in the fisheries sector, such as fishery capture activities.

The Map of Cultivation Centers (2016), states that the development of aquaculture production in West Papua is experiencing ups and downs with a growth rate of 23.07%. The types of commodities that experience an increase were carp, tilapia, catfish, snapper, grouper, and seaweed. The highest development was seaweed, with a production growth rate of 36%, followed by snapper with a growth rate of 18.09% and groupers at 8.38%.

The method of determining the sample (respondent) in the feasibility study of inland

and marine aquaculture in three districts (Manokwari, Maybrat, and Fakfak regencies). The selection of these three regencies was based on the consideration of representation of several regional and national commodity leaders (priority). Freshwater fish such as carp, tilapia, and catfish are both superior commodities and have the potential for development in Manokwari Regency, Maybrat, Bintuni Bay, South Manokwari, and other districts, whereas seaweed and grouper are national priorities.

Data analysis was carried out qualitatively and quantitatively. Qualitative analysis is to analyze the socio-cultural feasibility of fisheries. Quantitative analysis was carried out by analyzing the feasibility of aquaculture from non-technical and financial aspects by calculating investment criteria, namely NVP, net benefits/cost, IRR, payback period (PP) and sensitivity analysis.



The results of scoring and weighting are evaluated so that the suitability class is obtained, which describes the suitability of a field for a particular use.

The suitability level is divided into four class (Bakosurtanal, 1996), namely:

**1. Class S1: Highly Suitable**

This area does not have serious boundaries for implementing cultivation activities, or only has restrictions that are insignificant or have no significant effect on their use and will not increase the input or level of treatment given.

**2. Class S2: Moderately Suitable**

This area has decent environmental conditions but still has limiting factors, so it is necessary to increase certain treatments to increase the productivity of the area.

**3. Class S3: Marginally Suitable**

This area has slightly decent environmental conditions but also has limiting factors, so more treatments must be given to increase the productivity of the area.

**4. Class N: Not Suitable**

This area has unfavorable environmental conditions and has a permanent limiting factor, so that even if given treatments the productivity of this area still cannot be increased.

**Evaluasi Penilaian Kesesuaian Perairan untuk Lokasi Budidaya**

No	Kisaran Nilai (Skor)	Tingkat Kesesuaian	Evaluasi/Kesimpulan
1	85 – 100 %	S1	Sangat Sesuai
2	75 – 84 %	S2	Sesuai
3	65 – 74 %	S3	Sesuai bersyarat
4	< 65 %	N	Tidak sesuai

Non-financial analysis focuses on several aspects which include technical aspects, market aspects, and local feed material availability aspects. As for some technical aspects that are usually of concern — land use, water sources, water quality, soil texture and pH, topography, accessibility, distance from rivers, distance from settlements, climate (rainfall) — they will be adjusted to the type

of cultivation activities, whether in freshwater, brackish water, or marine cultivation. The market aspect consists of supply and demand, competition and business opportunities, marketing aspects, attitude of openness of the community and patterns of resource control.

## THE VALUE OF FISH CULTIVATION

Before conducting fish farming activities, the first step that must be considered in the preparation of aquaculture is soil and water management. The intended market in the tilapia aquaculture business is a reseller market, where individuals and organizations resell goods and services for profit. Technically, marketing of tilapia is more emphasized on the marketing strategy mix that is carried out because of the breadth of marketing activities. The mix marketing strategy consists of 4 components that greatly affect marketing success: product, price, distribution, and promotion. Determining location and distribution as well as supporting facilities and infrastructure is very important, because it must be easy for customers to reach each location and distribute goods and services. One form of distribution channel for tilapia aquaculture is from fish producers/farmers to collectors, agents, restaurants, and finally to the consumers.

The development of tilapia aquaculture in Maybrat Regency considers the potential of aquaculture based on the districts that are scattered in Maybrat Regency, such as Ayamaru District (Marumana River, Kampung Aves), Central Ayamaru District (Tet Sayoh River), North Ayamaru District (Setta River, Kampung Yukase, Kampung Aves and Krom Kampung Yubiah River, North East Ayamaru District (Imsun River, Mapura Village), Ayamaru Jaya District and West Ayamaru District (Wensi River, Kampung Soroan). Two types of cultivation techniques can be developed following the conditions of the existing district location.

- (1). Tilapia cultivation uses semi-permanent ponds.
- (2). Tilapia cultivation uses the floating net karamba method.



## GROUPER FISH CULTIVATION

Grouper fish is one of the fishery commodities whose export market is quite promising, and for the past 10 years it has developed rapidly. Due to the large demand of the international market, community initiatives have arisen to develop grouper fish business by cultivating KJA in addition to traditional efforts by fishing. To simplify the mastery and factors of production in the cultivation and marketing of grouper products and ensure the security of bank credit, the partnership pattern developed by the closed system mechanism can be mutually beneficial between partners, namely cooperatives and their members (plasma fishermen), large business and banking partners. Despite having good prospects and supporting natural resource potentials, grouper fish cultivation with the KJA system is still not widely practiced by the community in Manokwari Regency due to the small chance of successful cultivation. This is due to several obstacles faced by the community, the largest of which is the large capital to finance investment in the long term as well as business risks in grouper cultivation activity. Another obstacle is the limited availability of grouper fish in Manokwari and the continuous availability of feed (trash fish).

Based on the results of the interviews, there is no correct marketing route for the grouper KJA aquaculture business in Manokwari. At the time of the interviews the grouper either had not been harvested or was still in business. One example of a region or district that has prospects for grouper business development in Raja Ampat.

## Rantai Pemasaran Ikan Kerapu



## SEAWEED CULTIVATION

Seaweed is classified as a low-grade plant that generally grows attached to certain substrates, has no true roots or leaves, but has a stem called a thallus (Anggadiredja, 2011). For centuries seaweed or algae have been used by coastal residents in Indonesia for food and medicine. Currently, its utilization has experienced very rapid progress, namely processed seaweed can now be used as jelly, algin, carrageenan, and furselaran which is an important raw material in the food, pharmaceutical, cosmetics, and other industries (Cordi, 2010)

A general description of seaweed cultivation in the waters of Kampung Kiat by seaweed farmers is as follows: (1). Seaweed cultivation is a business carried out by one family, typically inherited from the parents. The workforce is the family members themselves. (2). The seaweed cultivation method used by farmers is the lane method, a combination of the raft and longline method.

3). There are 6 units in seaweed cultivation rafts, with a size of 4 x 6 m/unit. In each unit there are 16 ropes with a length of 6m and a distance of  $\pm 0.5$ m between ropes. There is a concrete anchor at the end of each unit, as well as a main buoy. For every 3m of rope, there are buoys made from 600ml aqua bottles. (4). The need for seaweed seedlings is 57.6 kg with a weight of 150 grams of FADs, and a distance of 0.5m between FADs. (5). The selling price of wet seaweed is Rp. 5,000 / kg, while dry is Rp. 10,000 – 15,000 / kg. In one year seaweed production has tripled, with a production time of about 1.5 months.

Currently, marketing is a major problem for seaweed cultivation because prices are unclear and there are fewer and fewer buyers. This is probably due to the fact that seaweed demand in Fakfak is decreasing.

### Jalur pemasaran rumput laut di Kabupaten Fakfak

1 Produsen (petani rumput laut)

2 Pedagang pengumpul/BUMDES

3 Industri / Surabaya

“not suitable” locations are in Kali Wimon, Johava, and Wensi.

- To develop freshwater agricultural businesses, researchers recommend tilapia (*Oreochromis niloticus*) cultivation due to its high economic value, high resistance to disease and water quality, broad tolerance for environmental conditions, ability to shape high quality protein, ability to grow in the aquaculture system, and ease of natural breeding so that availability of fish eggs is guaranteed.
- The development of the aquaculture industry must pay attention to environmental impacts, especially the increasing burden of pollution from organic waste originating from leftover feed and feces. The existence of organic waste will increase the nutrient content in receiving waters, which can cause water pollution and eutrophication. Bearing this in mind, in developing this business (opening new KJA ponds/units), attention must be paid to the carrying capacity of the environment.

## RECOMMENDATIONS

- Locations that have a rating of “highly suitable” are designated for seaweed cultivation in the waters of Kokas and Fakfak. Two locations with a “suitable” evaluation are designated for grouper agriculture in Sowi IV Manokwari Regency and seaweed farming activities in the Kiat waters of Fakfak regency. In Maybrat, there are two locations with ratings of “suitable” and three “not suitable” locations. The two locations that are “suitable” are Kali Framusa and Kali Marumana. The three

# Ecotourism

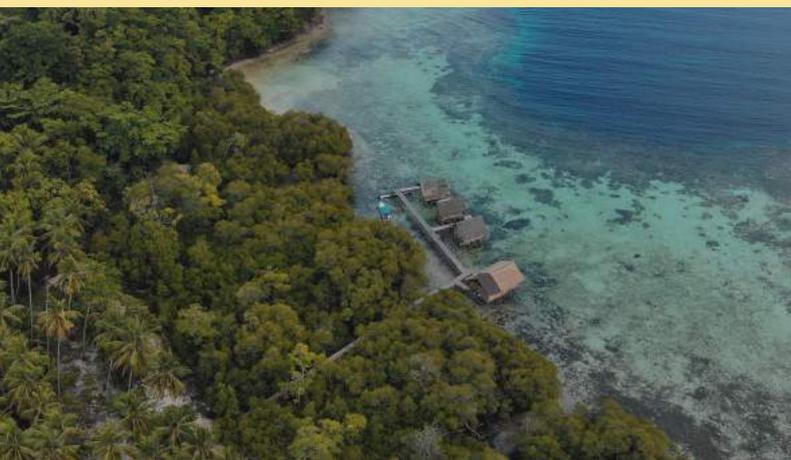
## SUMMARY OF ECOTOURISM RESEARCH IN WEST PAPUA

In the context of West Papua, the development of tourism is a priority as it is clearly stated in the fifth mission of the 2017- 2022 Medium Term Regional Development Plan (RPJMD). The focus on the fifth development mission is on increasing economic competitiveness and tourism based regional investment. In terms of tourist attractions, West Papua has extraordinary prospects because the potential attractions are very diverse and spread from the sea to the mountains.

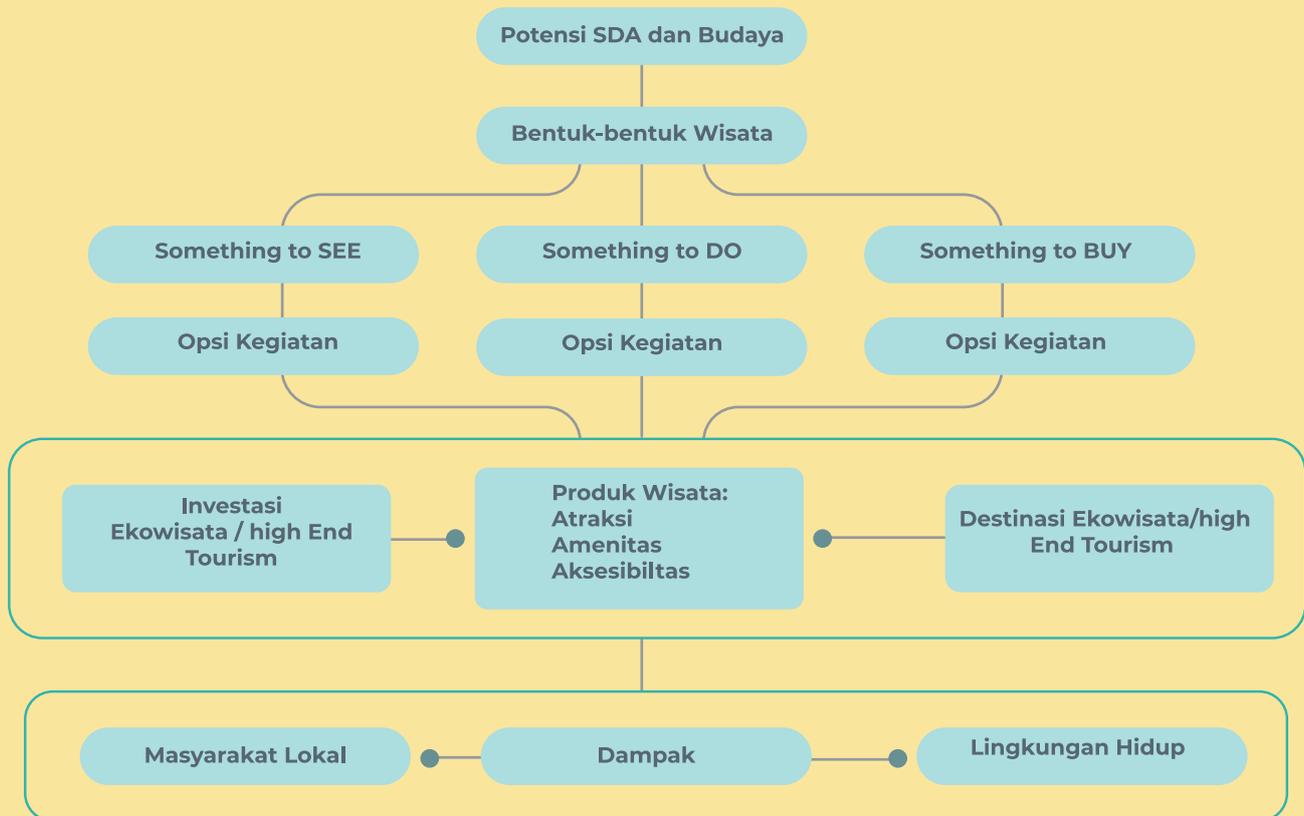
There are three tourism development areas (WPP). WPP 1 has service centers in Sorong City, WPP 2 is based in Manokwari, and WPP 3 is centered on Fakfak. (RIPPDA, 2011). The development of West Papuan tourism is currently focused on WPP 1, specifically Raja Ampat and surrounding areas. The number of foreign tourists staying at the homestays in Raja Ampat reached around 500-1000 people in 2018. The total income of all homestays in Raja Ampat is about Rp. 800 million – Rp. 1 billion per month. If there are many tourists on vacation, homestay turnover can reach Rp. 2 billion per month. On the other hand, WPP 2 and WPP 3 have relatively low levels of tourist visits. Tourism as a sector can provide a multiplier effect that has not had an impact on improving the economy of the local community, especially Papuans (OAP).

This study aims to determine the potential of ecotourism in West Papua and the investment value needed to develop the ecotourism area. The development of ecotourism areas as a sustainable tourism model in West Papua is done selectively, as there are tourist destinations in West Papua that cannot be developed into high end tourist attractions. However, the development of these locations takes into account the impact on the economy of local communities, and environmental sustainability both now and in the future. This is to support the government's commitment to develop West Papua with the concept of a conservation province. (Mindset on page 17).

The location of this study is Raja Ampat, the Arfak Mountains, and Kaimana. The techniques used in this study are desk research, field observations, and individual interviews. Data analysis included qualitative analysis, namely the tabulation of comparison and analysis of tables and graphs. The results of the quantitative analysis were analyzed using SWOT and descriptive analysis.



The framework for this study can be summarized as follows:



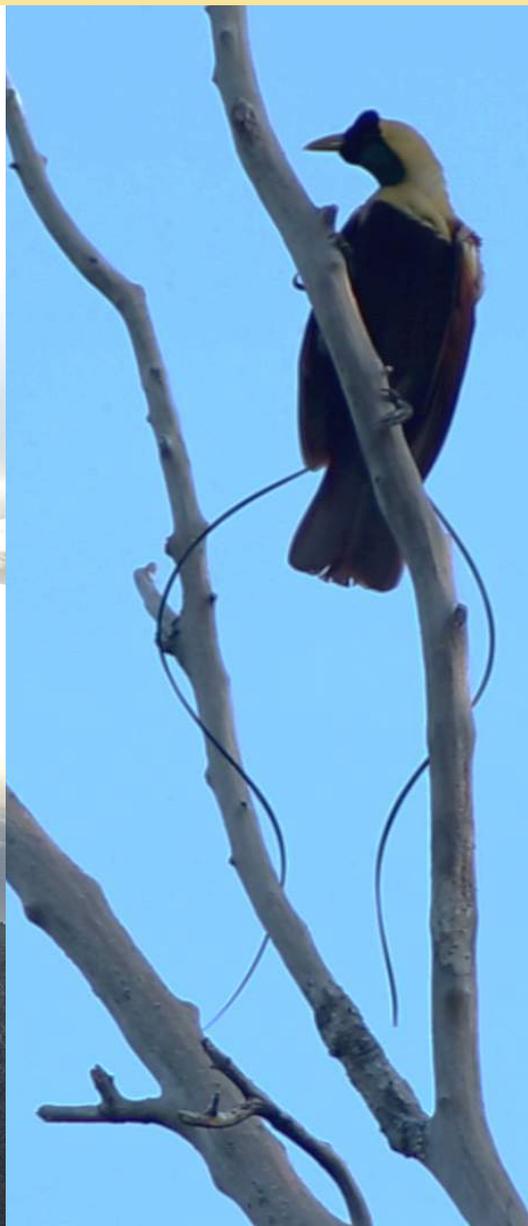
Quantitative analysis shows that the scoring results of tourist attractions (DTW) in the three regencies of the study area, namely in the Arfak Mountains (Lake Anggi Giji, natural caves and bird wing butterflies), Raja Ampat (Sapokren for bird watching, diving, and protected forests, Yenbuba for diving, and Kampung Iwasata in Sawandarek). In Kaimana, there are ancient cave paintings, Ermun Beach, and the Karst Islands. The three DTWs can be classified as follows based on weighting of the DTW value:

### Weight Percentage for Each DTW Assessment Parameter

No	Parameter	Bobot
1	Kualitas dan Keunikan DTW	0,25
2	Skala Pemasaran	0,20
3	Tingkat Kunjungan DTW	0,20
4	Tingkat Dukungan Aksesibilitas dan Pencapaian	0,15
5	Tingkat Dukungan Sarana dan Prasarana Penunjang	0,10
6	Pertimbangan Lainnya	0,10
	Total	1,00

**DTW Ranking for the Three Districts**

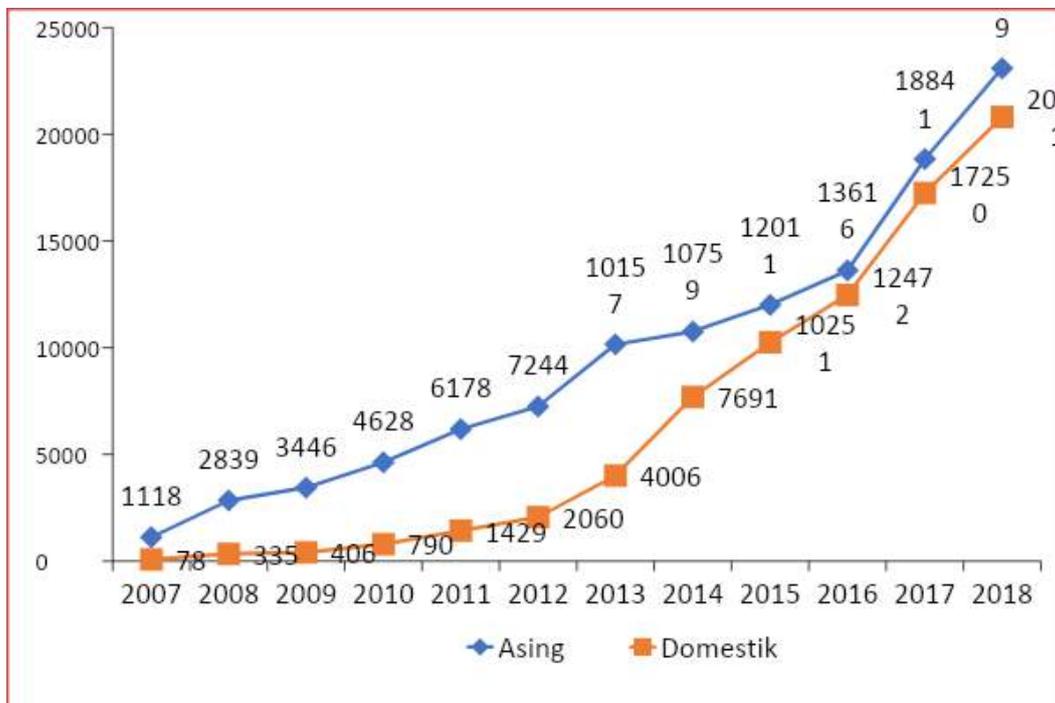
No	DTW UNGGULAN Peringkat "A"	DTW MENONJOL Peringkat "B"	DTW POTENSIAL Peringkat "C"
1	Danau Anggi Giji	Goa Alam	
2	Yenbuba (Diving)	Kupu-kupu sayap burung	
3	Sawandarek (Kampung Wisata)	Sapokren (Bird Watching, Diving dan Hutan Lindung)	
4	Pulau –Pulau Karts	Lukisan di dinding Batu	
5		Pantai Ermun	



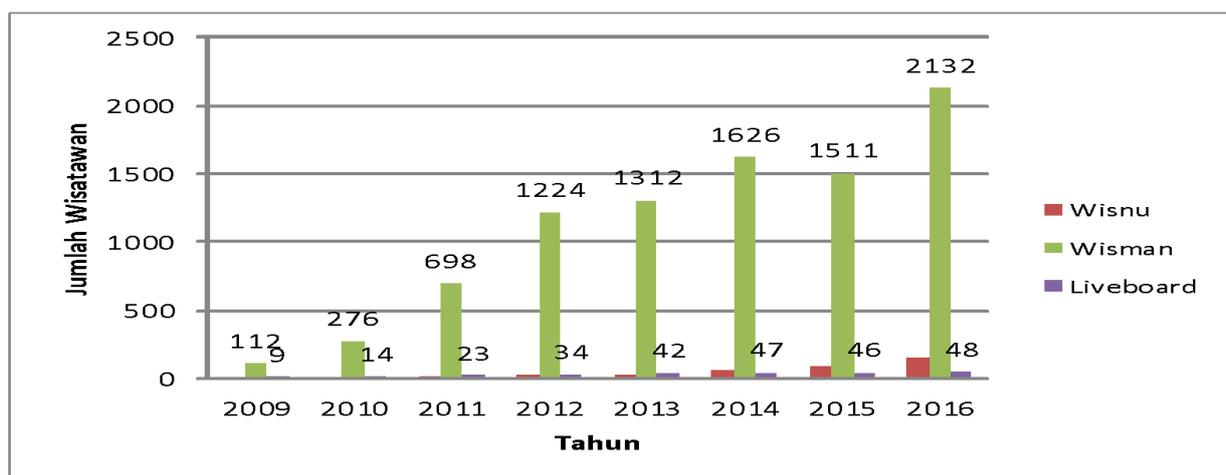
### Contribution of the Tourism Sector to Local Governments and Local Communities

The contribution of the tourism sector to district/city PAD in West Papua has not been recorded regularly. The PAD district in West Papua refers to Raja Ampat tourism activities as a benchmark.

**Tourist Visits to Raja Ampat (2007 – 2018)**



Additionally, Kaimana regency has had steadily increasing tourist visits. In 2009 there were 112 foreign visitors, which grew to 2,132 foreign tourists in 2016.



The workforce in the tourism sector in West Papua is 1,696 people (in 2015). Based on the workforce, around 19.5% are Papuans who work in hotels, restaurants, or as guides. The largest contributor is Raja Ampat. This means that this group is made up of OAP who have certain skills, however most of the OAPs around DTWs have not had the opportunity to manage tourism potential. This management pattern will be different depending on the types of tourism, so a strategic grouping of tourism areas and a management model appropriate for each DTW are needed.

### CONCLUSION

- Sustainable tourism in West Papua that supports conservation provinces: Socio-cultural tourism, religious/historical tourism, wildlife tourism, adventure tourism, nature-based tourism and ecotourism.
- In terms of West Papua's status as an island for those who love nature and natural beauty, it still has limited accessibility. As such, tourist attractions in West Papua deserve to be developed so tourism can grow into one of West Papua's leading sectors.
- There are 4 ecotourism areas that fall under the "superior" category at 3 case study locations, namely Lake Anggi Giji in the Arfak Mountains, Yenbuba and Sawandarek in Raja Ampat, and the Karst Islands in Kaimana. DTW that stand out are natural caves, bird wing butterflies, Sapokren, ancient cave paintings, and Ermun beach.
- Economically, the four attractions above can be developed into tourist destinations that will contribute to the economic growth rate of West Papua.
- The contribution of tourism to labor, the household economy, and added value is very low, especially for indigenous Papuan populations.
- The economic prospects of the West Papuan tourist markets are very good.
- The community-based ecotourism model is relatively effective for OAP

### RECOMMENDATIONS

- Leading DTWs such as Lake Anggi Giji, Yenbuba, Sawandarek, and the Karst Islands must be developed through cooperation between the local government and private sector.
- Development of tourism support facilities that favor OAP such as home stays should be encouraged, while limiting the number of resorts as they do not employ OAP.
- There must be a process of recognition and protection of indigenous rights in tourist areas.
- Establishment of ecotourism regulations based on indigenous peoples, especially in districts that have the largest conservation areas.
- Develop an integrated tourism special structure, based on the theme and character of tourism products and directed to improve the quality and role of the leading DTW as central developments.
- Increasing the quantity and quality of land and pier transportation facilities as well as lodging in provincial and regency/city capitals, which are the leading centers for DTW services.
- Provide policy initiatives in licensing facilities for entrepreneurs to invest and businesses in tourist support services such as transportation, lodging, and other services.
- Tourism development planning must consider aspects of business sustainability and the environmental risks development poses.
- Inventory and create a database of the main tourism products in each DTW and conduct online promotions to get regional, national, and international tourist markets.
- Encourage community organizations and local entrepreneurs (OAPs) to do business in tourism through policy and regulatory incentives.
- Prioritizing development activities in DTW areas with low regional accessibility but high-end tourism potential.
- Providing venture capital for community organizations, youth, women, and churches for tourism and arts & crafts centers based on local culture.
- Facilitating the empowerment of local wisdom in the preservation of natural resources and the environment, legalized by village regulations.

# DAFTAR PUSTAKA



## Food Security

- Badan Pusat Statistik Provinsi Papua Barat, 2012. Papua Barat Dalam Angka, Manokwari: BPS Provinsi Papua Barat.
- Badan Pusat Statistik Provinsi Papua Barat, 2014. Analisis Pendataan Lengkap Sensus Pertanian 2013: Potensi Pertanian Papua Barat., Manokwari: Badan Pusat Statistik Provinsi Papua Barat.
- Badan Pusat Statistik Provinsi Papua Barat, 2015. Survey Sosial Ekonomi Nasional: Analisis Pola Pengeluaran untuk Konsumsi Penduduk Provinsi Papua Barat, Manokwari: BPS Provinsi Papua Barat.
- Bintoro, D., Shandra, A., Ratih, K. D. & Destieka, A., 2013. Sagu Mutiara Hijau Khatulistiwa yang dilupakan. Bogor: Digreat Publishing.
- Cline, W., 2007. Global Warming and Agriculture. Washington DC: Peterson Institute for International Economics.
- Department of Nutrition Harvard T.H Chan School of Public Health, t.thn. The Nutrition Source: Protein.. [Online]  
Available at: <https://www.hsph.harvard.edu/nutritionsource/what-should-you-eat/protein/> [Diakses 3 February 2019].
- Dewi, R. K., M, H. & Sudrajat, 2016. Karakter Morfologi dan Potensi Produksi Beberapa Aksesori Sagu (*Metroxylon* spp.) di Kabupaten Sorong Selatan. *J. Agron. Indonesia*, 44(1), pp. 91-97.
- Dinas Pertanian Provinsi Papua Barat, 2017. Isu strategis dan analisa internal dan eksternal pertanian di Provinsi Papua Barat. [Online]  
Available at: <http://distanakpb.blogspot.co.id/2012/05/isu-strategis-dan-analisa-internal-dan.html>
- FAO/WHO/UNU Expert Consultation, 2004. Report of joint FAO/WHO/UNU Expert Consultation : Human energi requirements, Rome: FAO.
- Fisharis, B., 2001. Global energi and climate processes. The physical environment: A New Zealand Perspectiv: A Sturman and R. Sronken-Smith, Eds. Victoria: Oxford University Press.
- Folland, C. K., Renwik, M. S. & Mullan, A. B., 2002. Relative influences of the interdecadal Pacific Oscillation and ENSO on the South Pacific Convergence Zone. *Geophys. Res.Lett.*, 29(13), pp. 211-214.
- Food and Agriculture Organization of the United Nations, World Health Organization & United Nations University, 2007. Protein and amino acid requirements in human nutrition : report of a joint FAO/WHO/UNU expert consultation, Geneva & Switzerland: WHO.
- Griffiths , G., Salinger, M. & Leleu, I., 2003. Trends in extreme daily rainfall across the South Pacific and relationship to the South Pacific convergence zone, Volume 23, p. 847-869.
- Hanandita, W. & Tampubolon, G., 2015. The double burden of malnutrition in Indonesia: Social determinants and geographical variations. *SSM-population health*, Volume 25, pp. 1-16.
- Hariyanto , B., Atmadja, P., Putranto, A. T. & Kurniasari, I., 2015. Potensi dan Pemanfaatan Pati Sagu dalam Mendukung Ketahanan Pangan di Kabupaten Sorong Selatan Papua Barat. [Online]  
Available at: <http://www.jurnalpangan.com/index.php/pangan/article/view/23/18> Diunduh tanggal 26 Mei 2017 [Diakses 26 May 2017].
- Haryanto, B., Atmadja, P., Putranto, A. T. & Kurniasari, I., 2017. Sistem Produksi, Pengolahan Dan Pemanfaatan Hutan Sagu Untuk Penyediaan Pangan Karbohidrat di Papua Barat. [Online]  
Available at: [pse.litbang.pertanian.go.id/ind/pdffiles/PROS2013\\_E11\\_Bambang%20Hariyanto-1.pdf](http://pse.litbang.pertanian.go.id/ind/pdffiles/PROS2013_E11_Bambang%20Hariyanto-1.pdf) [Diakses 13 April 2017].
- Kementerian Kesehatan Indonesia, 2013. Hasil Utama RISKESDAS, Jakarta: Kementerian Kesehatan Indonesia.
- Kementerian Kesehatan Indonesia, 2018. Hasil Utama RISKESDAS, Jakarta: Kementerian Kesehatan Indonesia.
- Mahela & Sutanto, 2006. Kajian konsep ketahanan pangan. *Jurnal Protein*, 13(2), pp. 194-202.
- Mavalankar, D. e. a., 1994. Maternal weight, height and risk of poor pregnancy outcome in Ahmedabad, India. *Indian pediatrics*, 31(10), pp. 1205-1212.
- Novarianto, H., 2017. Sumber Daya Genetik Sagu Mendukung Pengembangan Sagu di Indonesia. Penguatan Inovasi Teknologi Mendukung Kemandirian Usahatani Perkebunan Rakyat. [Online]  
Available at: [http://perkebunan.litbang.pertanian.go.id/wp-content/uploads/2013/11/perkebunan\\_risalah\\_1.-Hengky-Novarianto.pdf](http://perkebunan.litbang.pertanian.go.id/wp-content/uploads/2013/11/perkebunan_risalah_1.-Hengky-Novarianto.pdf) [Diakses 2 Mei 2017].
- Nuttall, F. Q., 2015. Body Mass Index: Obesity, BMI, and Health: A Critical Review. *Nutrition today*, 50(3), pp. 117-128.
- Pakpahan, A., Saliem, S. H. S. & N, S., 1993. Penelitian Tentang Ketahanan Pangan Masyarakat Berpendapatan Rendah. Monograph Series No. 14 penyunt. Bogor: Pusat Penelitian Sosial Ekonomi Pertanian.
- Prendergast, A. J. & Humphrey, J. H., 2014. The stunting syndrome in developing countries. *Pediatrics and international child health*, 34(4), pp. 250-265.
- Rauf, A. W. & Lestari, M. S., 2009. Pemanfaatan komoditas lokal sebagai sumber pangan alternatif di Papua. *Jurnal Litbang Pertanian*, 28 (2), pp. 54-62.

- Revell, M. J. e. a., 2001. Interpreting low-frequency modes of Southern Hemisphere atmospheric variability as the rotational response to divergent forcing, *Mon. Weather Rev*, Volume 129, p. 2416–2425.
- Ropelewski, C. F. & Halpert, M. S., 1987. Global and regional scale pre-cipitation patterns associated with the El Nifio/Southern Oscillation, *Mon. Weather Rev*, Volume 115, pp. 172–182.
- Rouw, A. et al., 2014. Analisis Variasi Geografis Pola Hujan di Wilayah Papua. *Jurnal Tanah dan Iklim*, 38(1), pp. 25–34.
- R, S. & C, R., 2013. *The Double Burden of Malnutrition in Indonesia*. Jakarta: World Bank.
- Salinger, M. & GM, G., 2001. Trends in New Zealand daily temperature and rainfall extremes. *International Journal of Climatology*, 21(13), p. 1437–1452.
- Sari, A., 2014. Penetapan komoditas unggulan dalam upaya pengembangan agribisnis di Provinsi Papua Barat, Bogor: Institut Pertanian Bogor.
- Sastrapradja, S. D. & Elizabeth, A. W., 2010. *Keanekaragaman Hayati Pertanian Menjamin Kedaulatan Pangan*, Menteng – Jakarta: LIPI Press.
- Siswanto, et al., 2014. *Buku Studi Diet Total: Survei Konsumsi Makanan Individu Indonesia 2014*. 1 penyunt. Jakarta: Lembaga Penerbitan Badan Penelitian dan Pengembangan Kesehatan Kementerian Kesehatan RI.
- Subramanian, S. e. a., 2009. Association of maternal height with child mortality, anthropometric failure, and anemia in India. *Jama*, 301(16), pp. 1691–1701.
- Suhartini, 2009. Peran konservasi keanekaragaman hayati dalam menunjang pembangunan yang berkelanjutan. Yogyakarta, Fakultas MIPA. Universitas Negeri Yogyakarta.
- Trihono, A., Jahari, A. B. & Kartono, D., 2014. *Studi Diet Total: Survei Konsumsi Makanan Individu Indonesia*. Jakarta: Badan Penelitian dan Pengembangan Kesehatan Kementerian Kesehatan RI.
- Triyono, K., 2013. Keanekaragaman hayati dalam menunjang ketahanan pangan. *INNOFARM: Jurnal Inovasi Pertanian*, 11(1), pp. 12–22.
- WHO, 2010. *Nutrition Landscape Information System (NLIS) country profile indicators: interpretation guide*, s.l.: WHO.
- WHO, t.thn. *Body Mass Index – BMI*. [Online] Available at: <http://www.euro.who.int/en/health-topics/disease-prevention/nutrition/a-healthy-lifestyle/body-mass-index-bmi>. [Diakses 31 January 2019].
- Widjono, A. et al., 2000. *Jenis-jenis g Beberapa Daerah Papua*. Bogor: Pusat Penelitian Sosial Ekonomi Pertanian.
- Wyrтки, 1961. *Physical oceanography of the Southeast Asian waters*, La Jolla, California: The University of California.
- ### Aquaculture
- Affan, J.M. 2012. Identifikasi Lokasi untuk Pengembangan Budidaya Keramba Jaring Apung (KJA) Berdasarkan Faktor Lingkungan dan Kualitas Air di Perairan Pantai Timur Bangka Tengah. *Jurnal Depik*, Volume 1 (1) : 78–85.
- Badan Pusat Statistik Kabupaten Fakfak. 2013. *Statistik Daerah Kabupaten Fakfak 2013*.
- Badan Pusat Statistik Kabupaten Fakfak. 2014. *Kabupaten Fakfak Dalam Angka 2014*.
- Badan Pusat Statistik Kabupaten Fakfak. 2015. *Kabupaten Fakfak Dalam Angka 2015*.
- Badan Pusat Statistik Kabupaten Fakfak. 2017. *Kabupaten Fakfak Dalam Angka 2017*.
- Badan Pusat Statistik Kabupaten Manokwari. 2014. *Kabupaten Manokwari Dalam Angka 2014*.
- Badan Pusat Statistik Kabupaten Manokwari. 2015. *Kabupaten Manokwari Dalam Angka 2015*.
- Badan Pusat Statistik Kabupaten Manokwari. 2016. *Kabupaten Manokwari Dalam Angka 2016*.
- Badan Pusat Statistik Kabupaten Manokwari. 2017. *Kabupaten Manokwari Dalam Angka 2017*.
- Badan Pusat Statistik Kabupaten Manokwari. 2018. *Kabupaten Manokwari Dalam Angka 2018*.
- Badan Pusat Statistik Kabupaten Sorong Selatan. 2014. *Kabupaten Maybrat Dalam Angka 2014*.
- Badan Pusat Statistik Kabupaten Sorong Selatan. 2015. *Kabupaten Maybrat Dalam Angka 2015*.
- Badan Pusat Statistik Kabupaten Sorong Selatan. 2016. *Statistik Daerah Kabupaten Maybrat Dalam 2016*.
- Badan Pusat Statistik Kabupaten Sorong Selatan. 2017. *Kabupaten Maybrat Dalam Angka 2017*.
- Badan Pusat Statistik Kabupaten Sorong Selatan. 2017. *Kabupaten Maybrat Dalam Angka 2017*.
- Effendi, Hefni. 2003. *Telaah Kualitas Air (Bagi Pengelola Sumberdaya dan Lingkungan Perairan)*. Penerbit Kanisius, Yogyakarta.
- Gatot Yulianto, *Kajian Kelembagaan Hak Ulayat Laut 01 Desa-Desa Pesisir Teluk Bintun Buletin Ekonomi Perikanan VIII*, No 2 Tahun 2008.
- Handayani, Zulkarnaini, dan Syafridiman. 2015. Analisis Finansial dan Strategi Pengembangan Usaha Budidaya Ikan Kerapu (*Epinephelus sp.*) di Kecamatan Mantang Kabupaten Bintan. *Berkala Perikanan Terubuk*. Volume 43, No. 1: 57–66.

- Hernanto, A.D., S. Rejeki dan R.W. Ariyati. Pertumbuhan Budidaya Rumput Laut (*Euचेuma cottonii* dan *Gracilaria sp.*) dengan Metode Long Line di Perairan Pantai Bulu Jepara. *Journal of Aquaculture Management and Technology*. Volume 4, No. 2: 60-66.  
<http://www.sridianti.com/contoh-sikap-terbuka-dalam-kehidupan-bermasyarakat.html>
- Jailani, A.Q., E.Y. Herawati, dan B. Semedi. 2015. Studi Kelayakan Lahan Budidaya Rumput Laut *Euचेuma cottonii* di Kecamatan Bluto Sumenep Madura Jawa Timur. *Jurnal Manusia dan Lingkungan*, Volume 22, No. 2 : 211-216.
- Nurtanio Agus Puwanto, Kontribusi Pendidikan Bagi Pembangunan Ekonomi. *Jurnal manajemen pendidikan* No. 02/Th II/Oktobre/2006 hal 1-7.
- Suyanto, R. 2010. *Pembenihan dan Pembesaran Nila*. Jakarta: Penebar Swadaya
- Syamsuddin, Rajuddin. 2014. *Pengelolaan Kualitas Air (Teori dan Aplikasi di Sektor Perikanan)*. Pijar Press, Makassar.
- Tutupary OFW dan Maatoke CD. 2014. *Analisis Usaha Budidaya Rumput Laut di Desa Pediwang Kecamatan Kao Utara Kabupaten Halmahera Utara*. *Jurnal UNIERA* Volume 3 Nomor 1; ISSN 2086-0404
- Ecotourism**
- Badan Pusat Statistik dan Bappeda, 2017. *PAPUA Barat dalam Angka, tahun 2017*.
- Balai TNTC. 2006. *Buku Informasi Kawasan Taman Nasional Teluk Cenderawasih*. Balai TNTC. Manokwari.
- Balai TNTC. 2009. *Zonasi Taman Nasional Teluk Cenderawasih Kabupaten Nabire Provinsi Papua, Kabupaten Teluk Wondama Provinsi Papua Barat*. ANDI OFFSET. Jakarta
- Bansal, S.P. & Kumar, J. 2011. *Ecotourism for Community Development: A Stakeholder's Perspective in Great Himalayan National Park*. *International Journal of Social Ecology and Sustainable Development*, 2(2), 31-40.
- Fandeli C, Mukhlison, 2000. *Pengusahaan Ekowisata*. Kerjama Fakultas Kehutanan Universitas Gajah mada dan Pustaka Pelajar. Jogkarta.
- Fandeli C, 2002. *Perencanaan Kepariwisata Alam*. Pt. Perhutani (persero) dan Fakultas Kehutana Universitas Gejah Mada Jogjakarta.
- Marsh J. 1993. *An Index of Tourism Sustainability*. *Tourism and Sustainable Development: Monitoring, Planning, Managing*, Department of geography Publication University of Waterloo, Waterloo
- Murphy P.E.1985. *Tourism: a Community Approach*. Methuen. New York.
- Nurfadilah P.S.2018. "Realisasi Investasi Pariwisata Capai Rp 7,9 Triliun di Semester I 2018". <https://ekonomi.kompas.com/read/2018/09/27/055324926/realisasi-investasi-pariwisata-capai-r-79-triliun-di-semester-i-2018>. Diakses [6 mei 2019]
- Pearce D.G. 1989. *Tourism Development*. Wiley. New York
- Supriana N. 1997. *Pengembangan Wisata Alam di Kawasan Pelestarian Alam*. *Planning Sustainable Tourism*. ITB. Bandung
- Soemarwoto, O. 1991. *Interaksi Manusia dan Lingkungan: Faktor Kritis dalam Pembangunan Berkelanjutan*, Prisma I: 14-22
- Supriharyono. 2000. *Pelestarian dan Pengelolaan Sumberdaya Alam di Wilayah Pesisir Tropis*. PT. Gramedia Pustaka Utama. Jakarta.
- Sâmbotin, D., Sâmbotin, A., Pătrășcoiu, M., Coroian, A., Mercel, I. I. 2011. *Ecoturismul – Model de Valorificare Durabilă a Resurselor Turistice, Lucrări Științifice*, Seria I, Vol. XIII (4)
- Subiyanto. 1998. *Prospek Pengembangan Obyek Wisata di kawasan Ujung Genteng Kabupaten Sukabumi*, majalah Ilmiah Ilmu dan Wisata No. 18, Jakarta
- Salim, E. 1991. *Pembangunan Berkelanjutan: Strategi Alternatif Dalam Pembangunan Dekade Sembilanpuluhan*, Prisma I: 3-13.
- Tribe J. 1997. *Corporate Strategy for Tourism*. Thomson Publishing. London.
- World Tourism Organization. 2000. *Tourism Trends*. Madrid.
- Wyasa B. 2001. *Meluruskan Pengertian Ekowisata*. Tamasya. Jakarta



