The Effect of Global Warming on Tea Production. Case Study of PTPN XYZ in Indonesia

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Abstract

National consumption for tea in Indonesia is about 145 thousand (tonnes) annually with an increasing rate of 1.57 percent per year. Although the consumption rate has increased, national tea production has steadily declined over the last 10 years. Increasing temperatures due to climate change have been put forward as a contributing factor to the decline of tea production. In addition, the area of land used for tea production has decreased to make way for both housing development projects and other forms of cash crops. The conversion of land used for tea into other crops is in turn linked to increasing temperature and unstable weather conditions that aggravate tea production. Thus increases the cost of tea production and motivates tea plantations to switch to palm oil production or horticulture which produces higher profits. In this paper, PTPN XYZ of West Java, Indonesia is used as a case study to show the transition from tea production to alternative cash crops as a result of unsuitable weather conditions and its impact on decreasing national tea production.

Keywords: Tea, production, Indonesia, Global warming

Introduction

Although tea in Indonesia was first introduced the by the Portuguese in the 16th century, it was the Dutch that built the first tea plantation in 1684. The Dutch continued to establish numerous tea plantations throughout the Dutch East Indies, primarily for trade. After Indonesia's independence from the Dutch, tea production continued to thrive as an export product and in the 1980s, Indonesia was ranked as one of the top five countries tea producers worldwide.

The rise of tea production has also been boosted by internal, domestic tea consumption. On average, local demand for tea increases by around 1.57 % per year (Department of Agriculture, 2015) and with a population of nearly 250 million, Indonesia has maintained its status as one of the highest

markets for tea consumption. About 145,613 tones of tea are consumed domestically, and it is predicted to grow at a steady rate. However, contrary to the increasing demand for tea, national tea production in has declined 1.44 % through the years (Department of Agriculture, 2015).

In Indonesia, tea producers are divided into three types of producers: government owned companies (PTPN), small holders (farmers) and private estate companies. Figure 1 shows that in terms of individual parcels of land for tea production, 46% of tea production estates are owned by farmers, 30% by PTPN and 24% by private companies. It must be noted however, that although farmers own 46% of tea producing estates, the average amount of land owned by a single farmer is less than 0.6 ha.

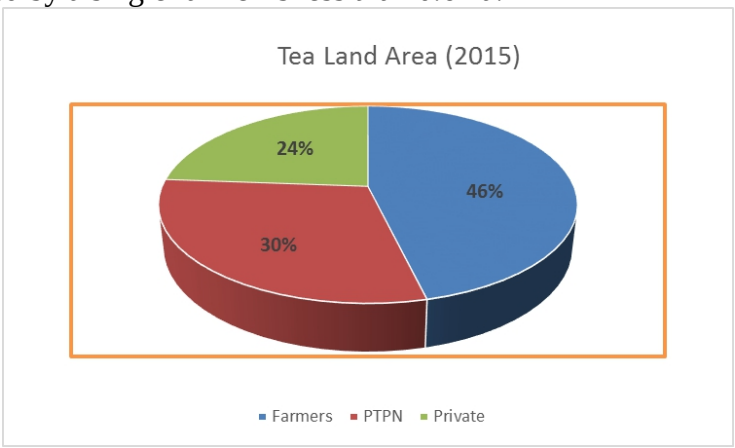

Figure 1. Distribution of tea land area based on type of producers in percentage (Department of Agriculture, 2015)

In 2015, the total number of tea producing land owned by farmers amounted to 55,176 Ha. At first glance, this figure outnumbers the total amount of tea producing land owned by PTPN at 35,738 Ha and the total of private companies at 28,447 Ha. Figure 2 however, shows that 41% of tea is produced by PTPN, 35 % by private companies, and only 24 % by farmers. This is due to the fact that farmers' use of simple techniques to cultivate their tea plantations as compared to the advanced techniques and machineries used by the large-scale, production techniques of PTPN and even to the private companies.

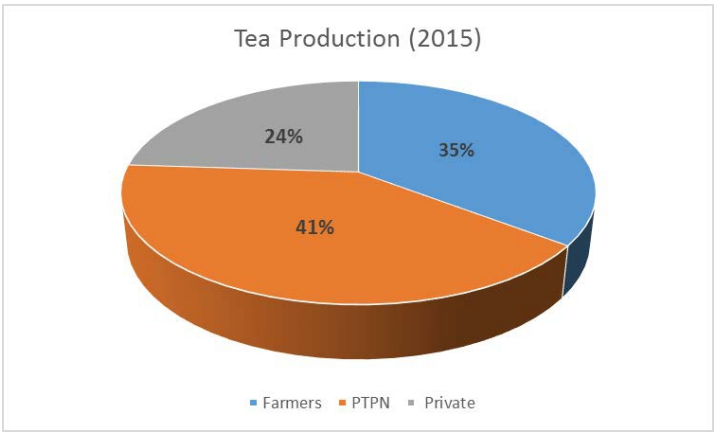

Figure 2. Distribution of tea production based on types of producers in percentage (Department of Agriculture, 2015)

Figure 3 below shows the distribution of tea land area based on province. The area in West Java has the largest tea area in Indonesia (77%) compared to the other areas in Indonesia. PTPN XYZ is a government-owned tea company located in Bandung, West Java that produces 80% of tea in West Java. The company alone has 24 tea plantations over 25,905.3 Ha and covers six districts.

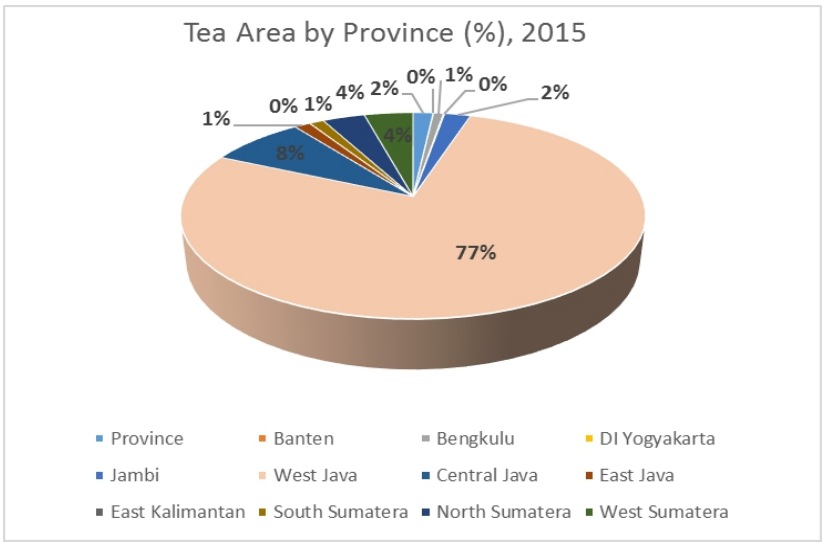

Figure 3. Distribution of tea area based on province in percentage (2015).

Tea cultivation requires fertile volcano soil, should ideally situated between 800-2.000 meters above sea level with temperatures ranging from 13° to 25° C. In addition, tea plants require an evenly distributed annual rainfall of at least 2.000 mm, but no more than two months of 60 mm (Department of Agriculture, 2015).

Figure 4 below shows how temperature fluctuates during the months in 2015 in West Java. This table shows that the highest temperature was close to 30° C in September of 2015 (Bureau of Statistics-BPS, 2016). This is highly significant since as stated above, the best temperature for tea should not exceed 25°C (Department of Agriculture, 2015).

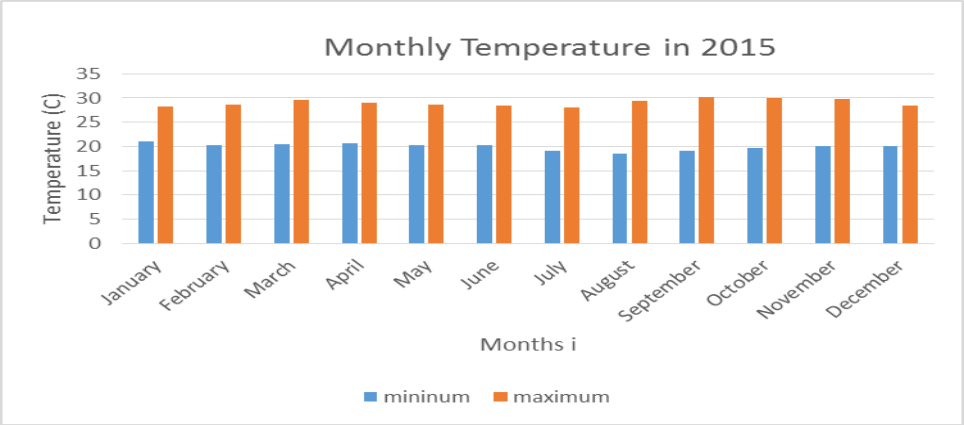

Figure 4. Monthly Temperature (°C) in West Java in 2015 (BPS, 2016)

Average temperature and precipitation are two main factors determining a region's climate and its effect on people; and the changes in temperature and climate conditions have been linked to global warming IPCC (Intergovernmental Panel Climate Change) on reports that temperature has been steadily increasing over the years and that temperatures increased by 0.74±0.18°C or 1.33± 0.32°during the 20th Century. IPCC has also predicted that there will be further rise in temperature from 1.1° to 6.4°C in the next century. (Anju, 2011).

Figure 5 shows the direct measurements from thermometers since 1860 (IPCC in Withgott and Scott, 2009). This paper will try to determine factors causing the decline in tea production, especially for PTPN XYZ.

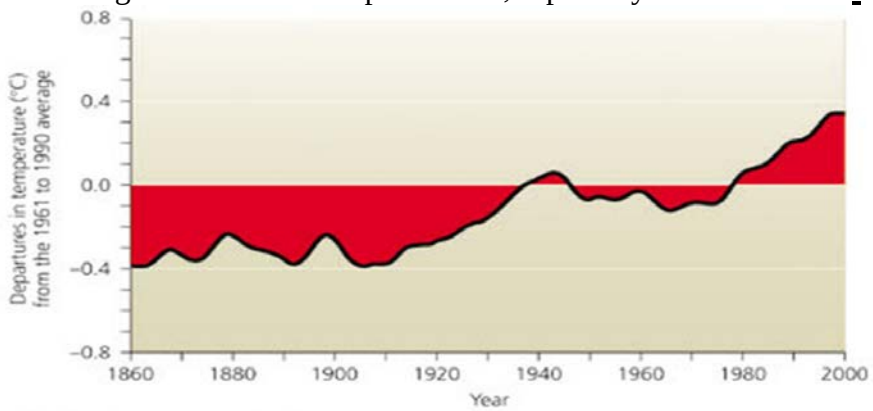

Figure 5. Graph showing average change of temperature worldwide from 1860-2000 (IPCC in Withgott and Scott, 2009)

Research Methods

This research is based on primary data collected through interviews and secondary data. Primary interviews were conducted with the Chairperson of the Indonesia Tea Committee (ITC), former Ministers of the Indonesian Agricultural Department, former Chairperson of the Indonesian Agronomists Association (PERAGI), former Chairperson of Indonesian Agriculture Meteorology Association (PERHIMPI) and the Head of PTPN XYZ. Secondary data consisted of statistical data, tables and graphs were also collected from Bureau Statistic of Indonesia (BPS), Statistics Data from the Indonesia Tea Organization, Bureau Statistics of West Java, Tree Crop Estate Statistics of Indonesia, Statistical tests such as regression models were used to analyze the data before presenting the results in graphs and tables.

Findings and Discussions

The results show that tea production has been declining continuously as much as 1.43 % annually (Department of Agriculture, 2015). On average, it can be seen that the average production of PTPN are the largest (50%) compare to farmers (27%) or the private companies (23%). Figure 6 shows tea productions through the years, where tea production declines for private company and for PTPN. Small holders have a slightly increase in production. Cost of tea production is half to 60% of the market price (ITC, 2016). Due to the high cost of tea production and the long duration time to harvest tea leaves (6-8 years since planted), farmers switch to short duration crops such as vegetables and fruits to meet their daily life expenditures (Rehman et al, 2015). Furthermore, farmers will abandoned their tea trees in order to generate more money by working elsewhere (ITC, 2016). Similar to this case, in Sri Lanka, cultivation tea is a supplementary source of income rather than the main source of income (Perera, 2014). Farmers also grow tea in marginal lands (Rehman et al, 2015) which are worsen by farmer's inability to maintain the tea trees with fertilization, weeding or irrigations. Lack of capital, modern machines, lower market value, lower yield per hectare are also causes farmers' inability to produce quality tea (Nasir and Shamsuddoha, 2011). Although the Indonesian government has subsidized the farmers with quality seeds and fertilizers, this action is not continual (ITC, 2016). Thus, because of the production of the low quality of tea, the price they earn (Rp 1,700-1,800/kg) are lower compared to price earned by the large companies (Rp 3,600/kg) (PTPN XYZ report, 2015).

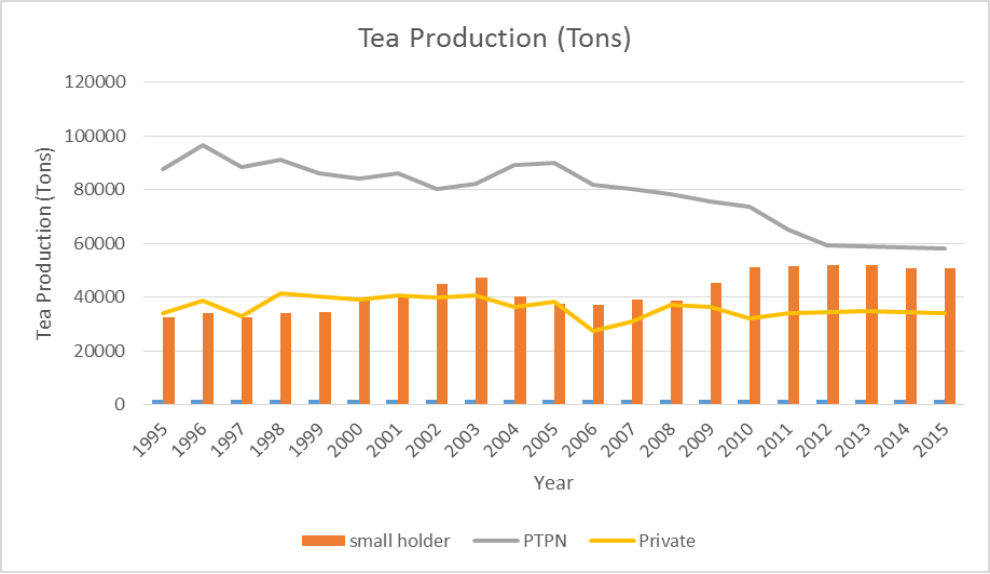

Figure 6. Tea Production (tons) throughout the years (Department of Agriculture, 2015)

Other factor causing the decline in tea production is land conversion. Tea land area has been declining as much as 1.4 % annually where land conversion from tea is either to real estate use or to conversion of tea to other plants. Thus, farmers consider tea not as economically interesting compared to other crops.

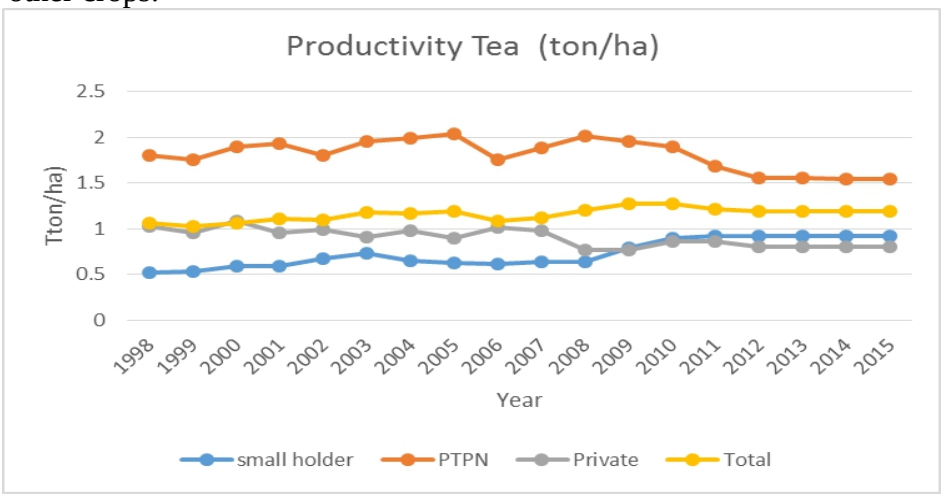

Figure 7. The Condition of Tea Productivity in Indonesia (Department of Agriculture, 2015)

Productivity of PTPN and private companies decline throughout the years, however productivity of smallholder farmers were increasing with a lower tea quality. In the past farmers harvest the tea selectively based on quality, but recently, tea leaves were picked based on numbers (quantity). As

a result, the price received by smallholder farmers, are much lower than price received by large companies.

Many PTPN also convert tea land to other crops such as palm oil, which is considered to be more economically profitable. Every decrease of tea price of 1% per kg generates land conversion from tea to pam oil crops as much as 0.613% (Purba, 2010). The other reason for the declining tea production is related to the increase of temperature which causes less and unsuitable climate for tea cultivation.

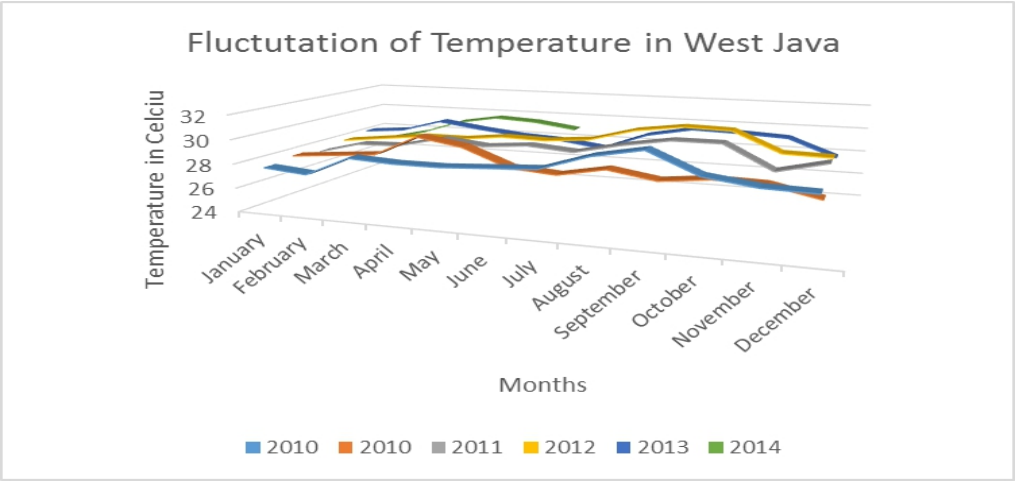

Figure 8. Fluctuation of Temperature in West Java for the Last Five Years (BPS, 2015)

From the figure above (Figure 8), temperature has been fluctuating through the years. According to Houghton et al (2001), world temperature will continue to increase which is caused by further emissions of greenhouse gasses. In just three years since 2010, the temperature in West Java had increased an average of 1°C.

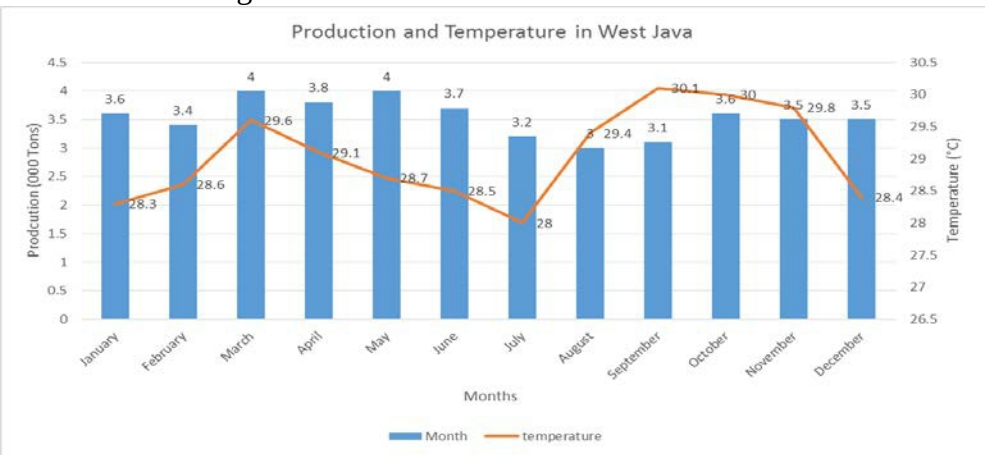

Figure 9. Distribution of Tea Production (000 tons), Months in 2015 and Temperature in West Java (BPS, 2015)

From the figure above, it can be seen that tea production is low in the month of August (3,000 tons) and September 2015 (3,100 tons) while temperature in the West Java area are highest during that year (30°C) (BPS, 2015). The ideal temperature to grow tea is between 13-25°C (Department of Agriculture, 2015). Therefore, the high temperature becomes less suitable to grow tea crops.

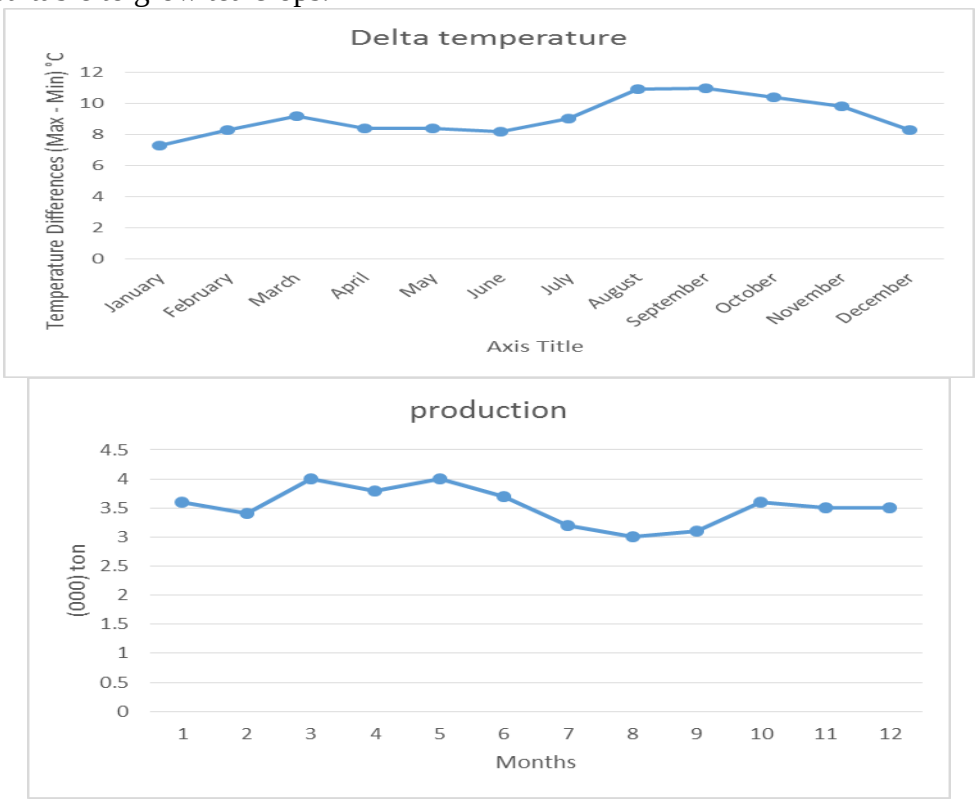

Figure 10. The Illustration of Temperature Differences and Tea Production in West Java

From Figure 10, we can see that the large the difference of temperature between maximum and minimum, the lower the tea production, Global warming cause the differences between maximum and minimum temperature to be more larger. Furthermore, an increase of 1°C in temperature will cause a decline in tea production of 5%. Therefore many tea areas area are being converted to other type of crops that are more suitable for this conditions.

The tea plantations that are being converted are usually the area with the lowest elevations. Unfortunately many of these tea land area are owned by the PTPN, where the temperatures are at the maximum range to plant tea. Peng et al in Marjuki et al (2016) found that paddy field yield decline by 10% for every increase of 1.8°C during growing season. The high nighttime temperature results in a high respiration rate, which reduces net dry-weight

gains. Agricultural production will be affected by global warming through changes in yields and market prices (Kobayashi, 2009).

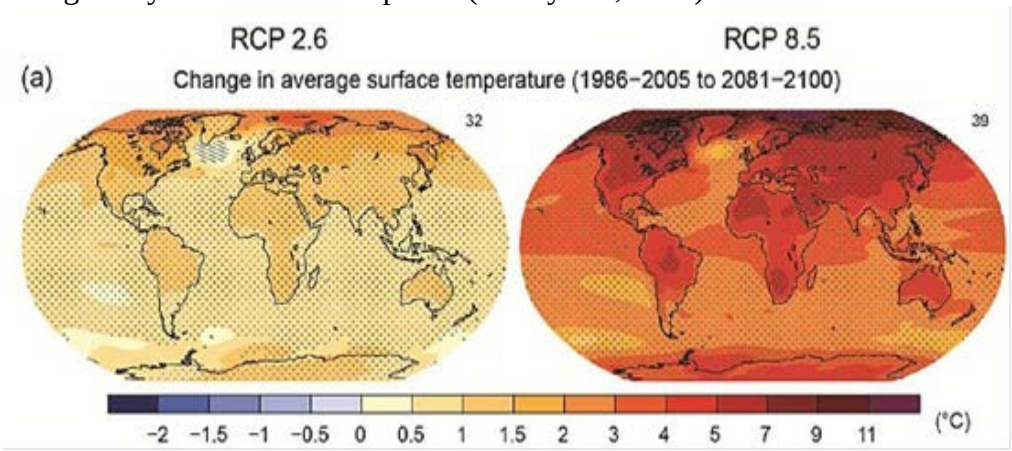

Figure 11. Change in Average World Surface Temperature (1986-2005 to 2081-2100) (Mora et al, 2013).

Figure 11 shows how world temperature has increased since 1986 and the prediction to year 2100 (Mora et al, 2013). The figure above illustrates the increase in world global temperature in the future. If an increase of 1°C will reduce tea production by 5%, with a steady increase of 0.74°C annually will cause the next 10 years tea productivity to fall by 37%.

Conclusion:

Tea production has been declining despite an increase rate of tea consumption. Factors causing the decline in tea production are declining tea area and productivity. Shrinkage of tea area and productivity are caused by land conversion to other crops, real estates and the increasing temperature especially in the lower elevation.

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