

BMP's FOR FACING DROUGHT STRESS ON OIL PALM

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Outline



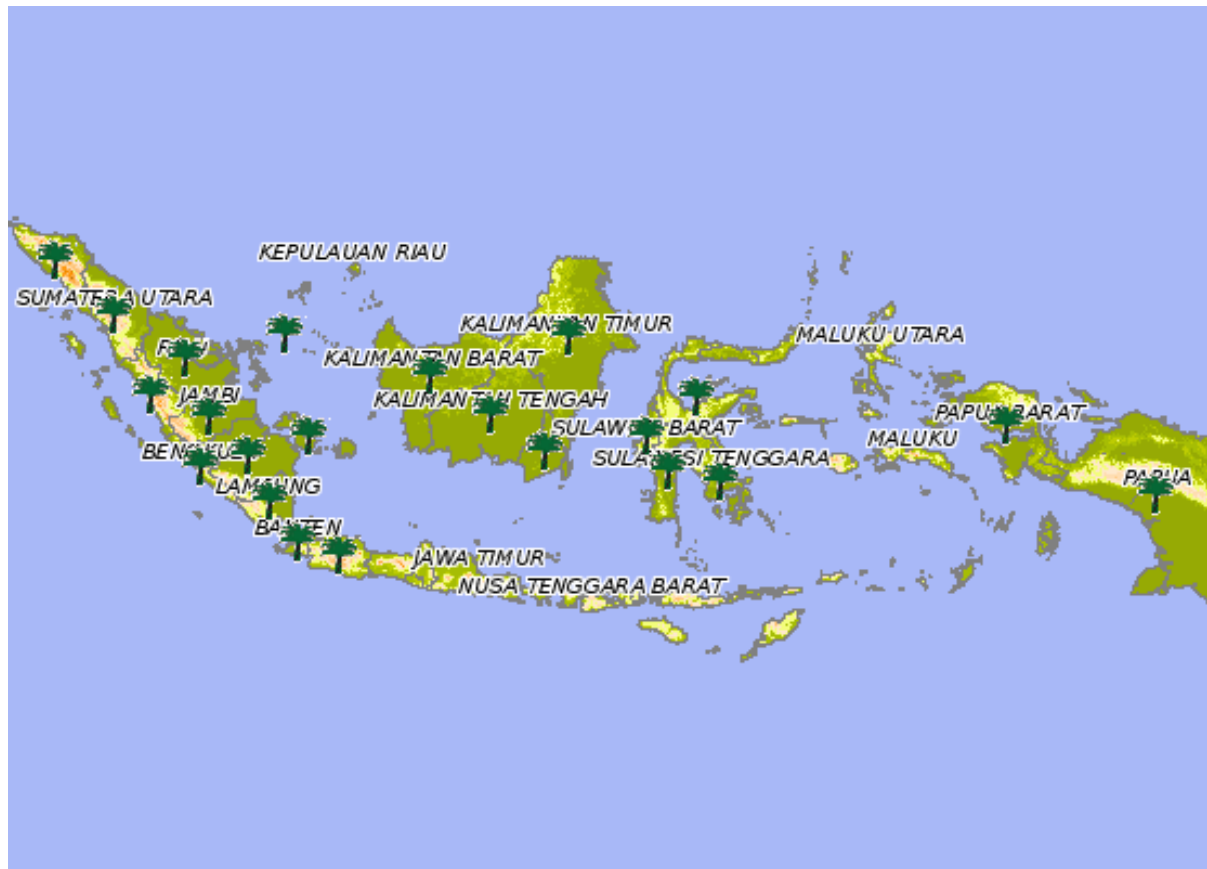
- Introduction
- El Niño 2015
- Effects of drought stress on oil palm
- BMP's : Pre, during, and post drought stress
- Conclusion

Introduction

Rainfall & Oil Palm

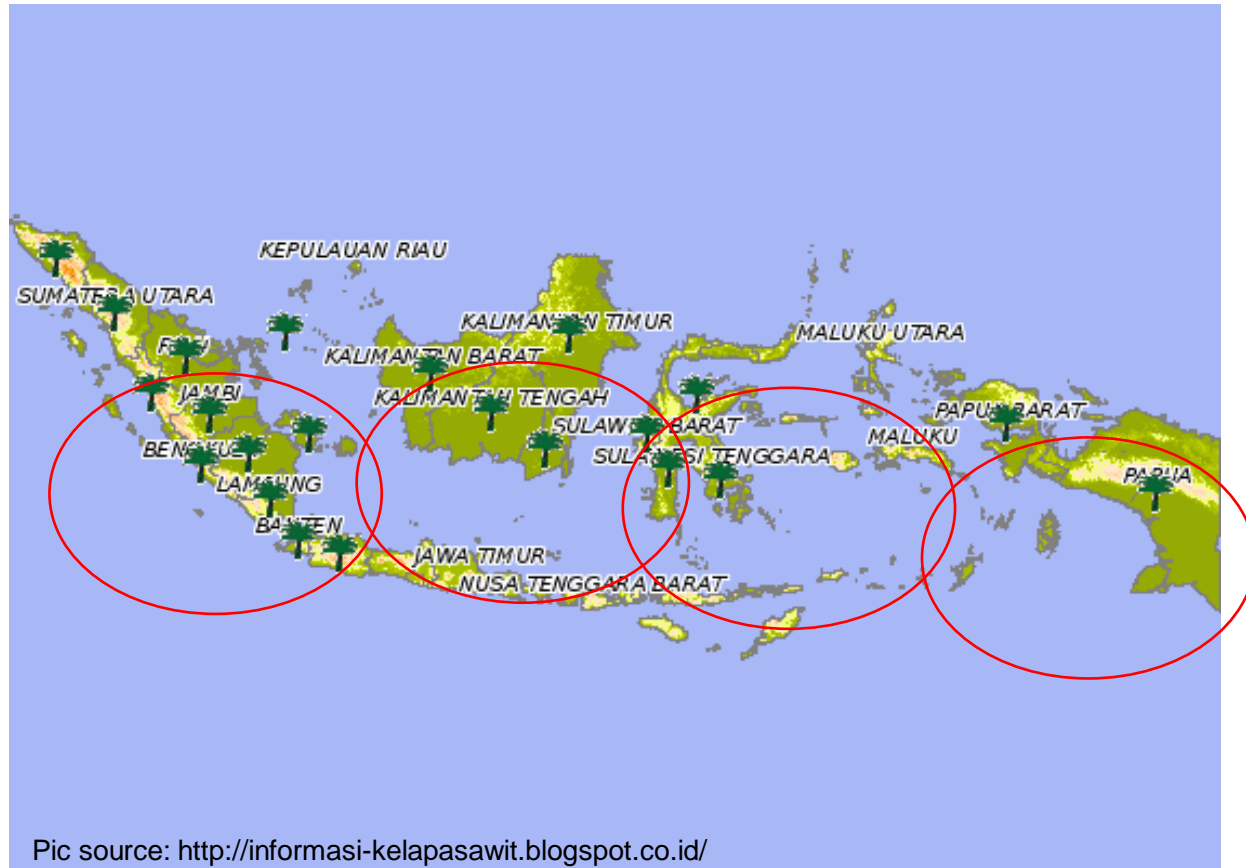
- Annual rainfall 1750 – 3000 mm / year
- Monthly rainfall > 60 mm
- Minimum water deficit and dry spell incidences

Oil palm has been grown in Sumatra, West Java, Kalimantan, Sulawesi, Maluku, and Papua



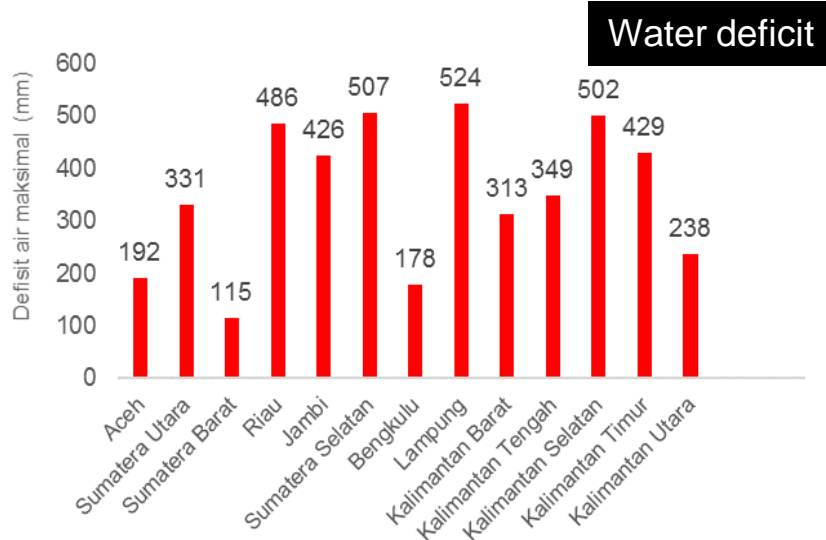
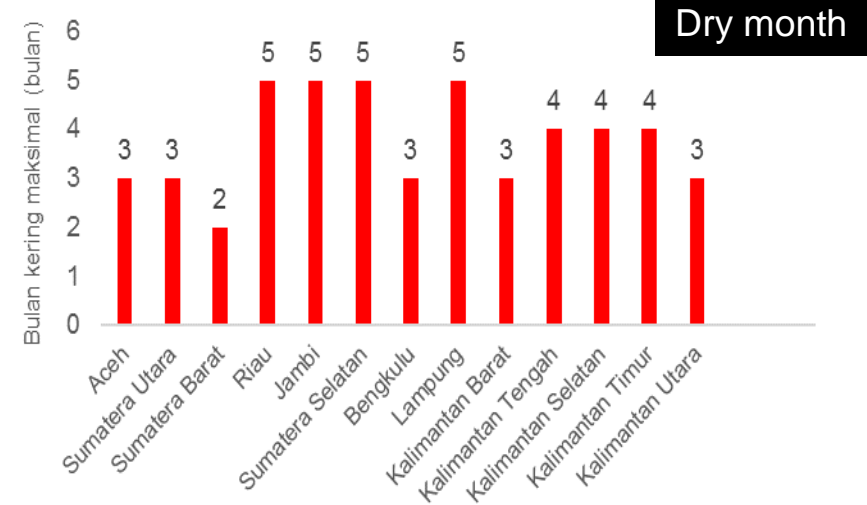
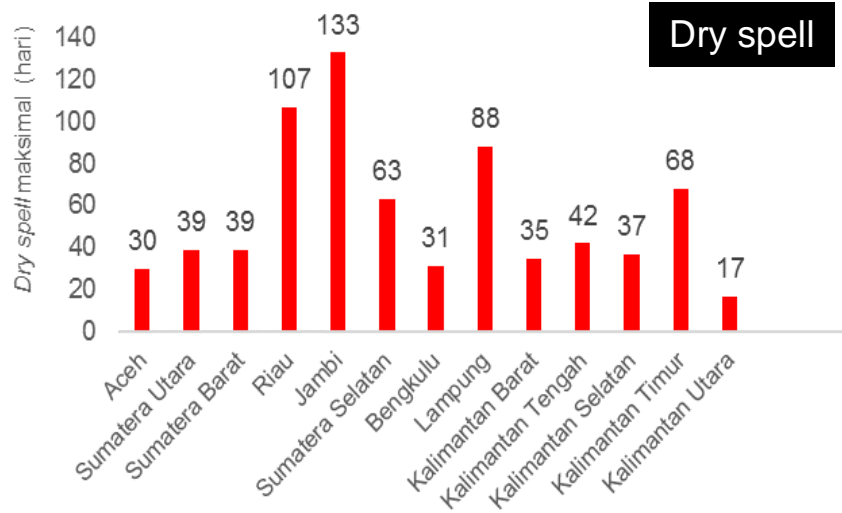
Pic source: <http://informasi-kelapasawit.blogspot.co.id/>

Potential of high water deficit incidence in the regions with monsoonal rainfall , worse with climate anomalies (i.e., El Niño)



El Niño 2015

Sumatera & Kalimantan



- **Southern part of Sumatra** suffered longer dry spell, dry month, and higher water deficit than other regions in Sumatra.
- **Central, East and South Kalimantan** suffered longer dry spell, dry month, and higher water deficit than other regions in Kalimantan.

Triggers of drought stress on oil palm

- Annual rainfall < 1250 mm/year
- Water deficit > 200 mm/year
- Dry month (rainfall < 60 mm/month) > 3 months
- Dry spell > 20 days

Symptoms of drought stress on oil palm

Low sex ratio



Bunch malformation



Abortion



Problems on fronds: >2 spear fronds, fronds fracture, early senescence.



Water deficit & fronds during El Niño 2015

Locations & samples number	Water deficit	Spear fronds (fronds per palm)	Frond fracture incidences (frond/palm)
Aceh (7 estates)	192	0-1	0-4
North Sumatra (33 estates)	331	0-1	0-4
Riau (20 estates)	486	1-3	2-8
West Sumatra (4 estates)	115	0-1	0-2
Jambi (8 estates)	426	1-4	4-14
South Sumatra (7 estates)	507	1-4	4-14
Bengkulu (1 estate)	178	0-1	0-2
Lampung (3 estates)	524	3-6	4-24
West Kalimantan (9 estates)	313	0-1	0-4
Central Kalimantan (3 estates)	349	1-2	0-4
South Kalimantan (3 estates)	502	3-6	4-24
East Kalimantan (5 estates)	429	3-5	4-16
North Kalimantan (1 estate)	238	0-1	0-2

*Observation covered at least 75% area of each estate.
(Source: Pradiko et al., 2016)*

Prolonged Dry Season & Soil



Source: google.com

Drought may cause soil crack which can lead to damage on tertiary and quaternary palm roots.

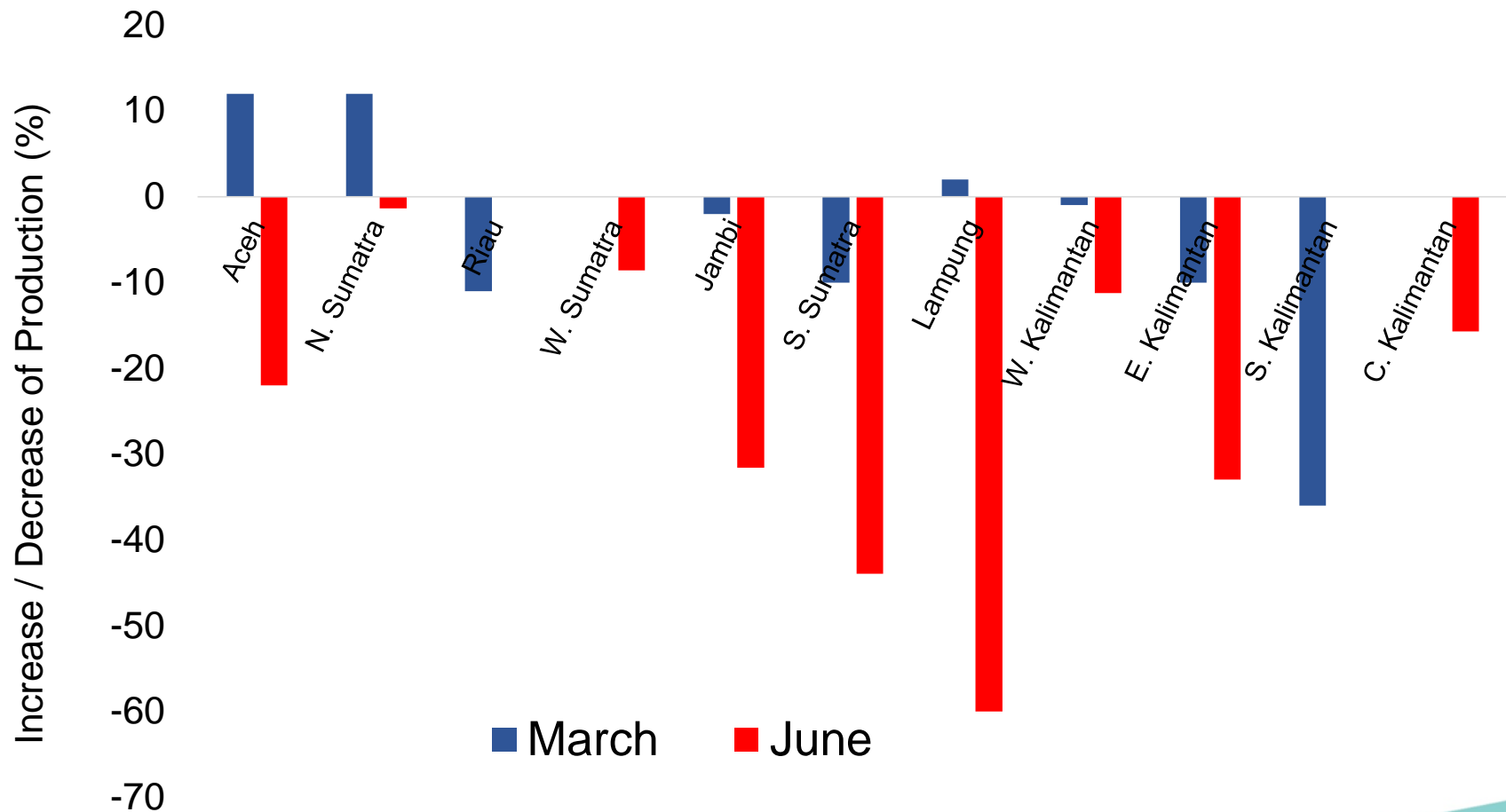
Prolonged Dry Season & Pest Attacks



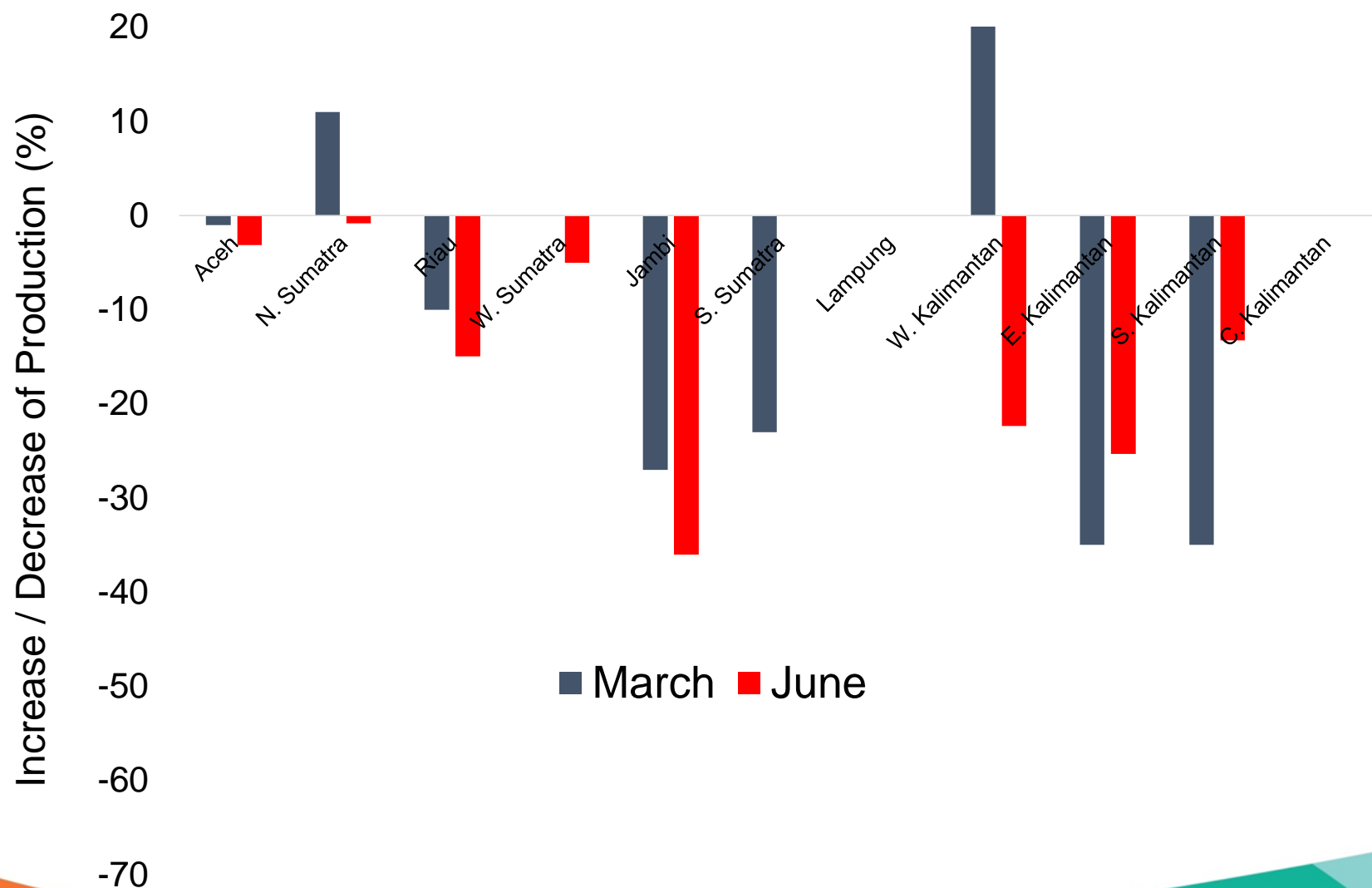
Pic by IPO

Drought could lead to increase pests, such as caterpillars and rats.

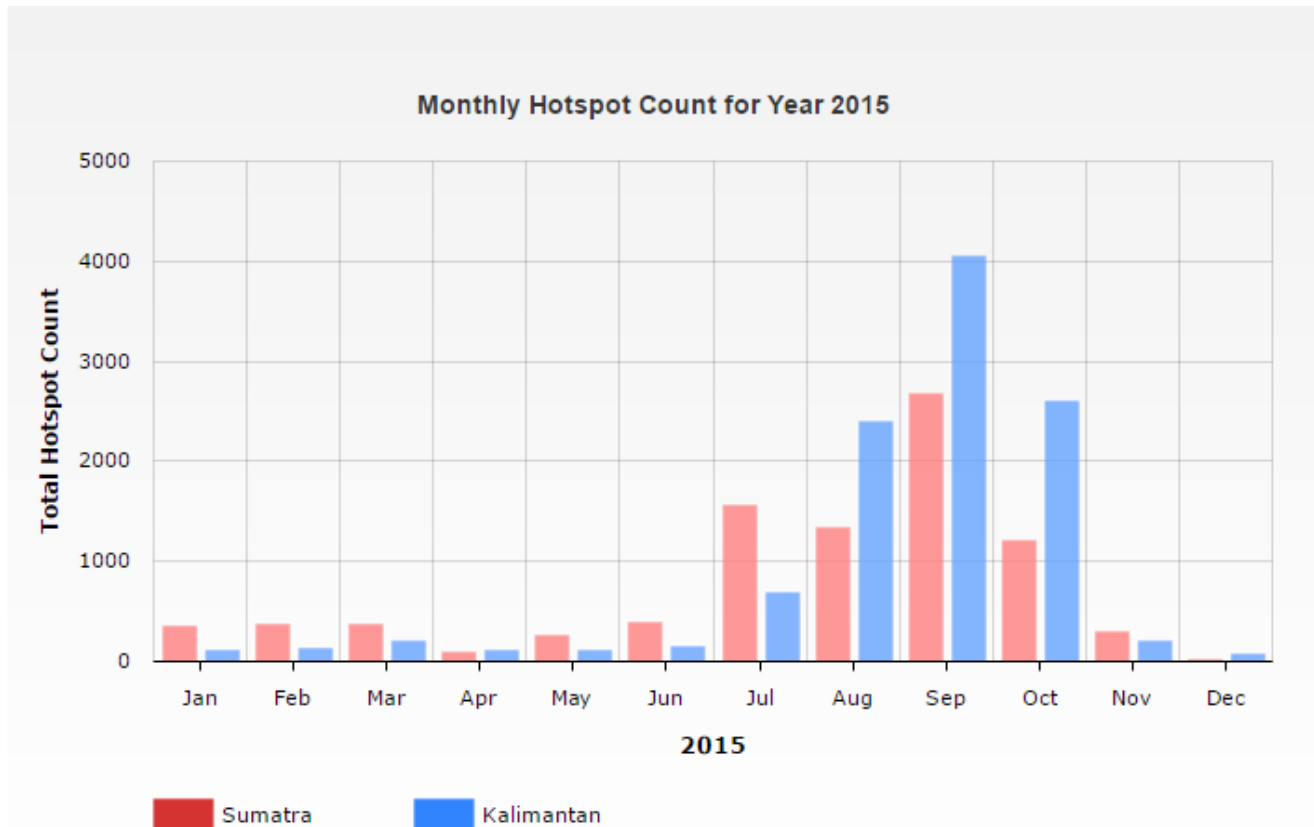
% relative yield 2016 to 2015, government owned companies



% relative yield 2016 to 2015, private companies



El Niño 2015 caused extreme drought & increased number of hotspots and haze.



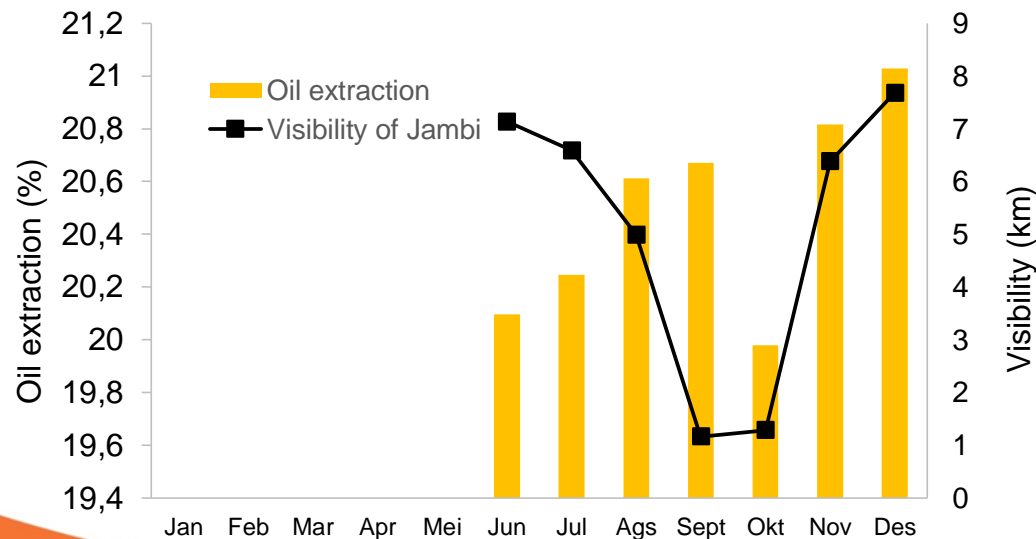
Source: ASMC

Haze from land and forest fires may affect *E. kamerunicus*, yield, and oil extraction.



Effects of haze on oil palm yield & oil extraction

Location	Haze impacts (months)	Yield decrease (%)		
		Year X	Year X+1	Year X+2
North Sumatera, Riau, and Jambi	1	1,6	1,4	0,2
	2	3,5	3,2	0,4
	3	5,5	5,0	0,5



A case study in Jambi
Oil extraction (CPO only) dropped by 0.60% following the decrease of visibility level due to haze in October 2015

A photograph of a tropical landscape featuring a calm pond in the foreground. The pond's surface reflects the surrounding dense forest of tall palm trees. The trees are lush green, and the sky is a clear, pale blue. The overall scene is peaceful and serene, typical of a tropical environment.

BMP's in an area with the risks of drought stress

Before drought stress : Preemptive actions

During drought stress: Minimizing impacts

After drought stress : Recovery

Preemptive Actions

1. Continuous monitoring and evaluation of climate conditions

- Manual or Automatic Weather Station to generate data for establishing an alert system of drought stress.



Preemptive Actions



Pic by MSR

2. Agronomic practices

- Castration for immature palms.
- Proper fertilizing : type, dosage, time, and method.
- Discipline canopy management : 48-56 fronds (<8 years) and 40-48 fronds (\geq 8 years)

Preemptive Actions

3. Application of Empty Fruit Bunch or EFB compost

Maintaining soil organic matter to increase water holding capacity of the soil.



Preemptive Actions

4. Cover crop management

- Cover crop should be maintained.
- Blanket system to eradicate all of cover crops in the soil surface is not recommended.



Preemptive Actions

5. Establishing soil and water conservation



Silt-pit



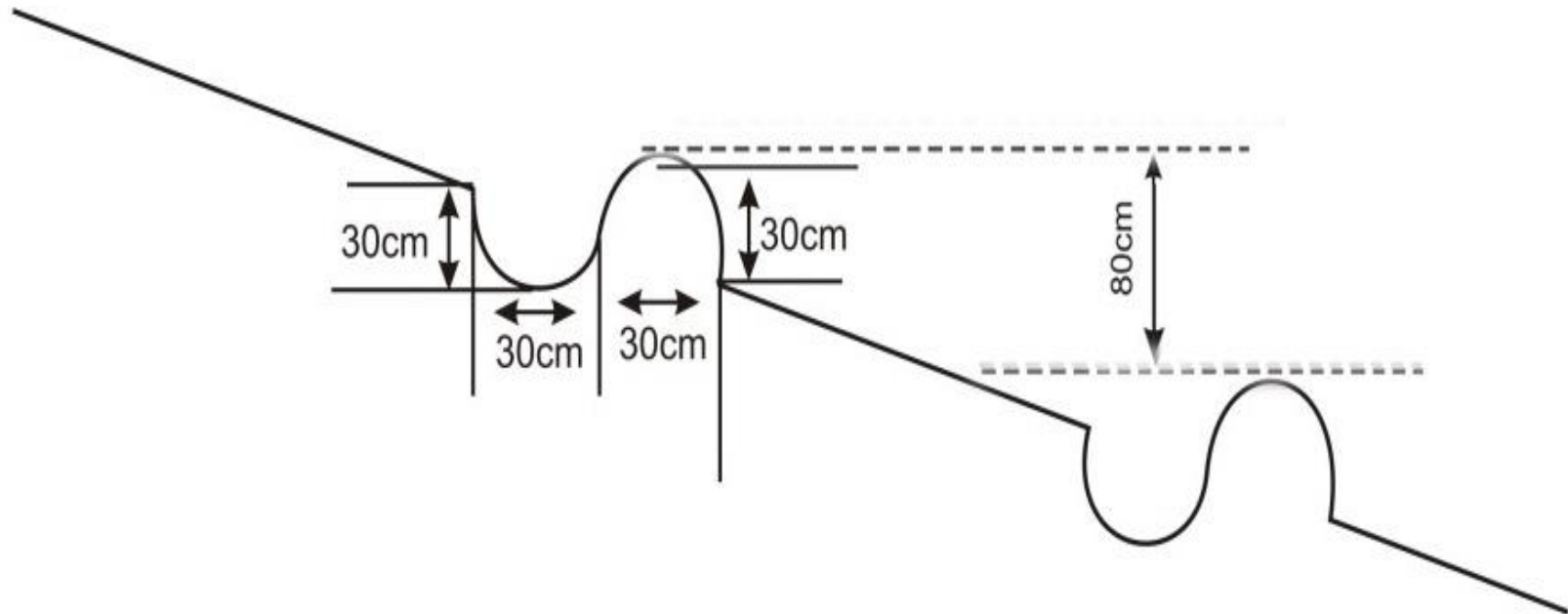
Bund Terrace

Water balance under treatment of control, bond terrace, and silt pit (Dec 2007 to Dec 2008, a case study in Lampung).

No	Variable	Bund Terrace	Control	Silt pit
1	Rainfall (mm)	2200.12	2359.48	1997.44
2	Interception (mm)	398.29	472.21	229.38
3	Total runoff (mm)	253.35	472.59	152.4
4	Evapotranspiration (mm)	1099.32	1099.32	1099.32
5	Water storage (mm)	449.16	315.36	516.34

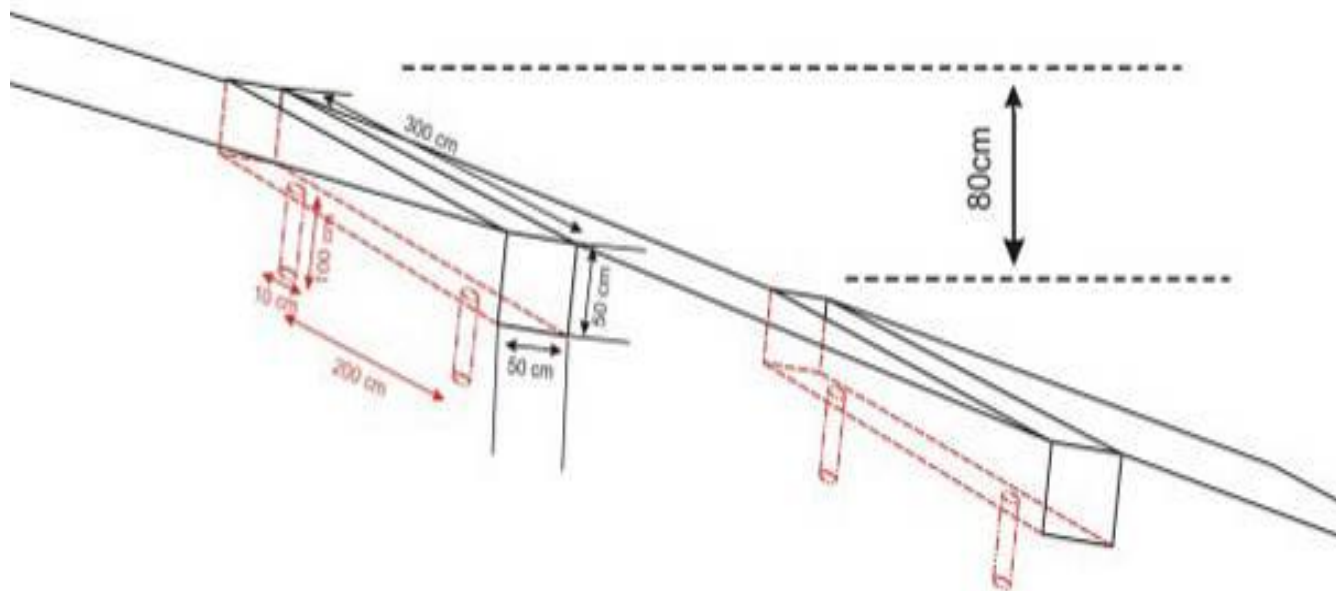
Source :Murti Laksono et al., 2011

Bund Terrace



Bund terrace is established parallelly with contours in a vertical interval of about 80 cm. The height, width, and depth of each bund terrace are about 30 cm. In the ditch path, *biopori* (50 cm depth) is built at every 2 m. Organic matter (palm leaves, cut fronds, shredded EFB) can be added into the *Biopori*.

Silt Pit



Silt pit is built parallelly with contour in a zig-zag pattern between contours. The dimensions is 300 cm length, 50 cm width, and 50 cm depth. Distance between a silt pit to the next silt pit is about 2 m. Two *Biopori* holes can be applied in the silt pit, the distance between two holes is 2 m. Organic matter (palm leaves, cut fronds, shredded EFB) can be added into the *Biopori*.

Effects of combination of bund terrace and cover crops management (*N. bisserata*), a case study in Lampung

Month	Treatment	Growth variables		
		Frond fracture incidences (fronds / palm)	Average leaf area (m ²)	LAI
August 2014	G ₀ T ₀	16.3	9.90	5.80
	G ₀ T ₁	15.3	9.89	5.80
	G ₁ T ₀	13.3	9.89	5.80
	G ₁ T ₁	7.3	9.89	5.80
December 2014	G ₀ T ₀	15.3	10.29	5.88
	G ₀ T ₁	6.3	10.29	5.89
	G ₁ T ₀	4.5	10.02	6.02
	G ₁ T ₁	0.3	10.06	6.04
April 2015	G ₀ T ₀	5.3	10.49	6.00
	G ₀ T ₁	5.3	10.42	6.26
	G ₁ T ₀	5.3	10.48	6.29
	G ₁ T ₁	0.3	10.50	6.30

Note : G₀ = without bund terrace; G₁= using bund terrace; T₀ = without cover crops; T₁ = using cover crops
(*N.biserrata*)

Effects of combination of bund terrace and cover crops management (*N. bisserata*), a case study in Lampung

Month	Treatment	Variable of production			
		Number of male inflorescence (inflorescence/palm)	Number of female inflorescence (inflorescence/palm)	Number of bunches (bunches/palm)	Weight of bunches (kg/FFB)
August 2014	G ₀ T ₀	3.0	0.0	3.0	-
	G ₀ T ₁	0.3	0.0	5.5	-
	G ₁ T ₀	1.3	0.0	1.0	-
	G ₁ T ₁	0.3	3.3	5.5	-
December 2014	G ₀ T ₀	3.3	0.0	2.8	-
	G ₀ T ₁	0.3	1.3	5.0	-
	G ₁ T ₀	1.3	0.0	0.5	-
	G ₁ T ₁	0.0	3.5	5.8	-
April 2015	G ₀ T ₀	3.0	2.8	2.3	24.1
	G ₀ T ₁	1.0	2.3	4.5	25.3
	G ₁ T ₀	0.8	1.5	0.0	25.3
	G ₁ T ₁	0.3	2.0	4.5	26.0

Note : G₀ = without bund terrace; G₁= using bund terrace; T₀ = without cover crops; T₁ = using cover crops

(*N.biserrata*)

*) Observation result with others researcher

Canal blocking on peat soil



Maintain soil water level at about 40-60 cm.

During drought stress: Minimizing Impacts



- Pruning should be delayed especially on young palms.
- Activities can be focused on road construction and maintenance, including drainage systems

During drought stress: Minimizing Impacts



- Rescheduling application of fertilizers when rainfall is <60 mm/month.
- Simple irrigation or applications of palm oil mill effluent.

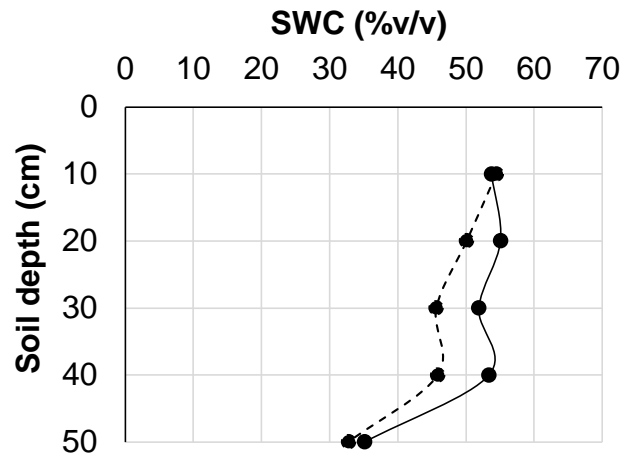


During drought stress: Minimizing Impacts

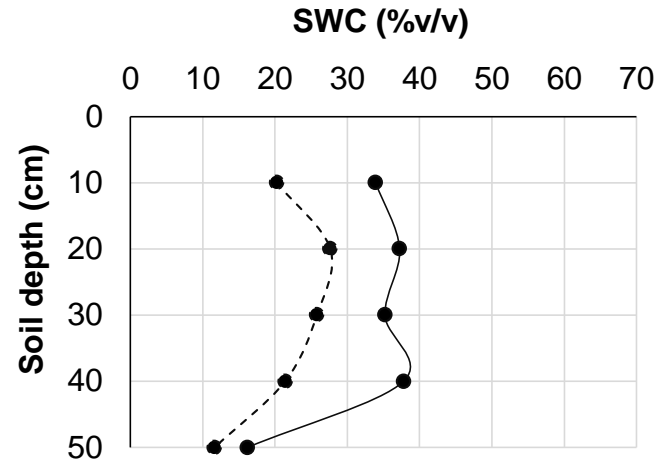


- Minimizing use of chemicals for weeding control.
- Monitoring and integrated pests control
- Hotspots monitoring to prevent land and forest fires

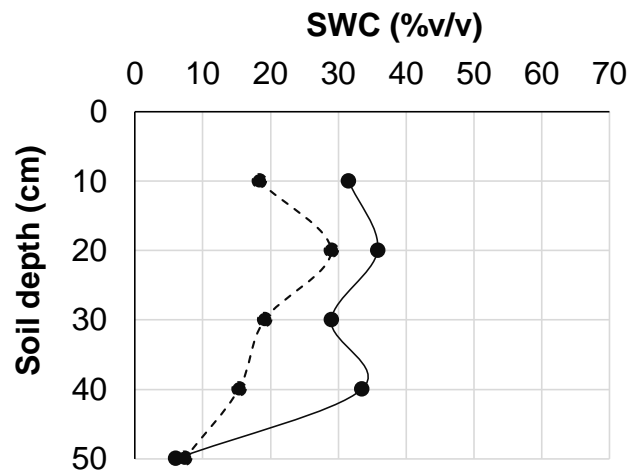
August 2014 (Dry season)



September 2014 (Dry season)



October 2014 (Dry season)



Profil of soil water content (SWC) in plot without (T_0) dan with (T_1) cover crops, a case study in Lampung

Legend:
 - - ● - - T_0
 — ● — T_1

After drought stress: Recovery



Continuing fertilizer application when rainfall is
>150 mm/month or 50 mm/10 day

After drought stress: Recovery



Monitoring on fungal and bacterial infections, especially on palms with high incidences of frond fracture and bunch malformation by applying proper canopy management.

Conclusion

- Oil palms in southern part of major islands in Indonesia are potentially vulnerable to drought stress due to monsoonal rainfall, worse with El Nino.
- Drought stress may decrease yield
- BMP's are required to face the drought stress, including preemptive actions, minimizing impacts, and recovery.

Thank you

