



A VIEW INTO CLIMATE CHANGE IMPACT SCENARIOS FOR JAMAICA CCFPJA - JVMA ONE HEALTH DAY CONFERENCE 2019

Alicia A. Hayman Ph.D.
November 3, 2019
Alhambra Inn Hotel

Louder conversation,
more and more alarming
news in recent times



Abaco, The Bahamas



Dominica



Puerto Rico



Barbuda

Climate change is about the 'UNPREDICTABLE'!

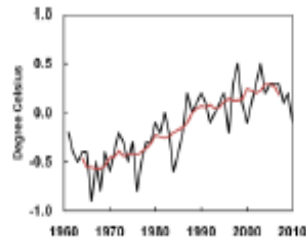
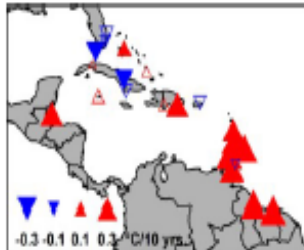
Our climate is not behaving as it used to!

1

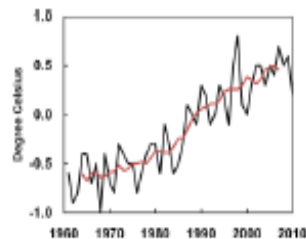
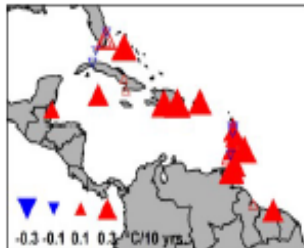
Unpredictable

It's hotter

Hot days



Hot nights

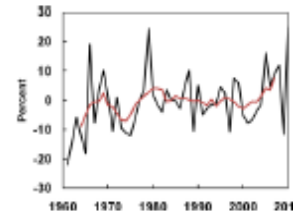
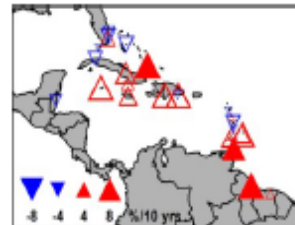


~ 1 degree rise since pre-industrialized times.

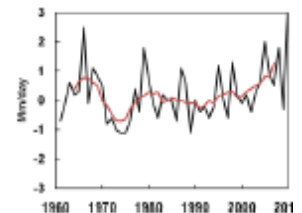
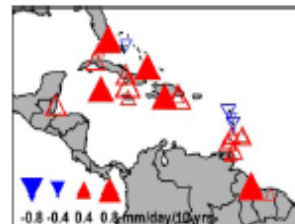
Earlier and longer summers

Rain is more variable

Total Rainfall



Intense Rainfall



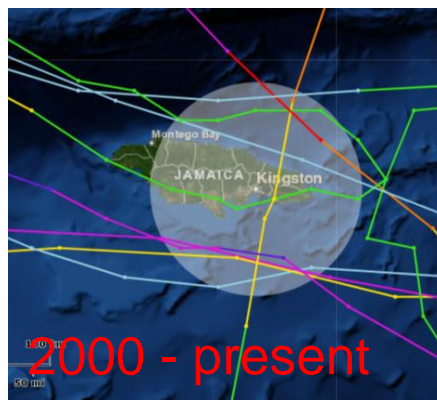
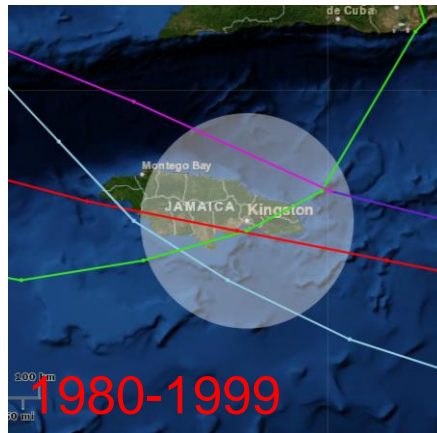
(1) Very variable rainfall pattern + (2) some places getting wetter, some getting drier + (3) 'nature' of rain is changing

Climate change is about the 'UNPREDICTABLE'!

Our climate is not behaving as it used to!

1
Unpredictable

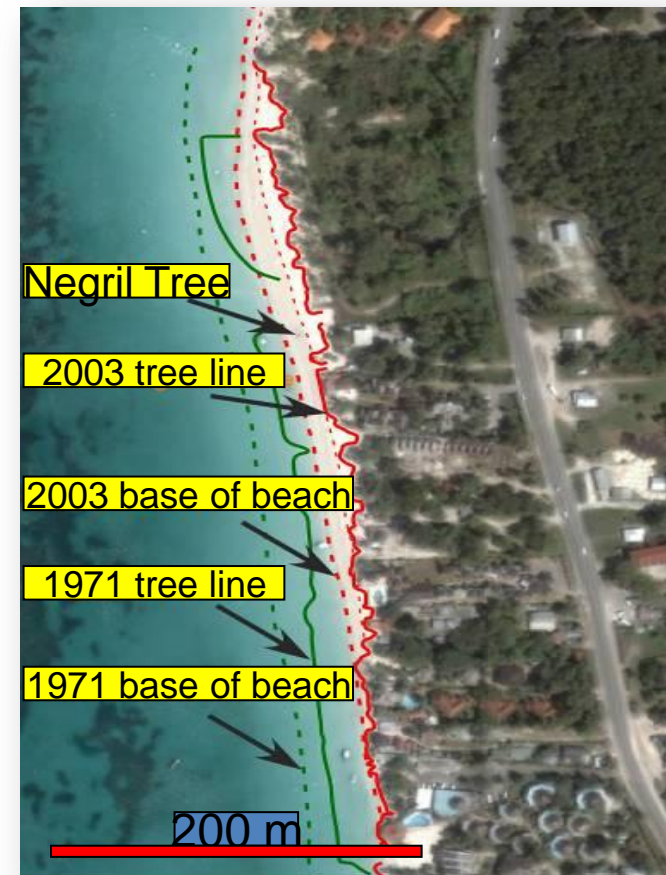
More extremes



Sea levels are rising at about a rate of 3.5 mm/yr (post 1993)

Changing climate leads to changing weather and extreme events.

Higher Sea Levels



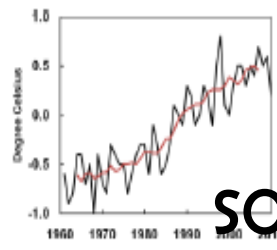
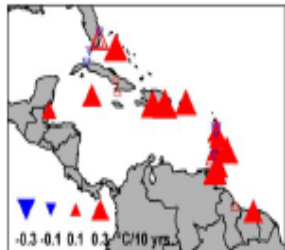
Climate change is about the 'UNPREDICTABLE'!

Our climate is not behaving as it used to!

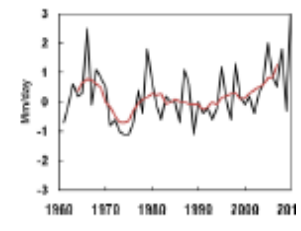
1
Unpredictable



It's hotter



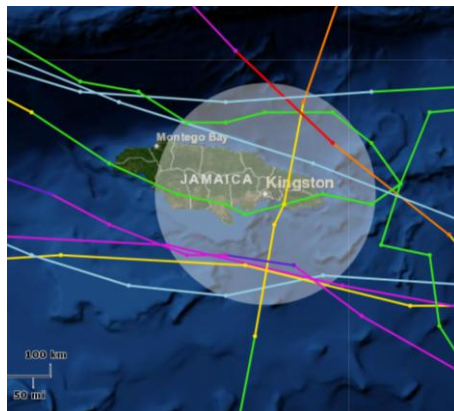
Rain is more variable



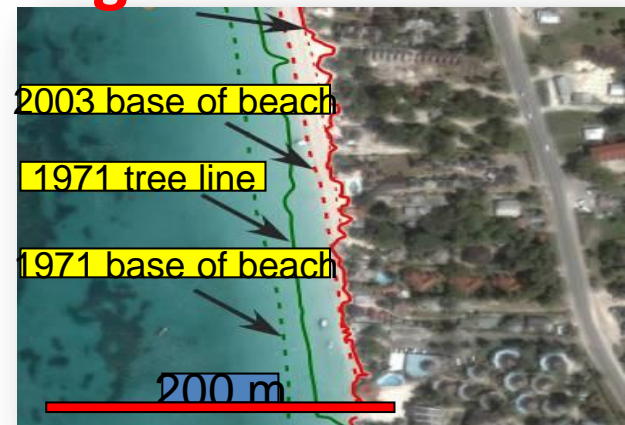
SO WHAT?

What does this have to do anything?

More extremes



Higher Sea Levels



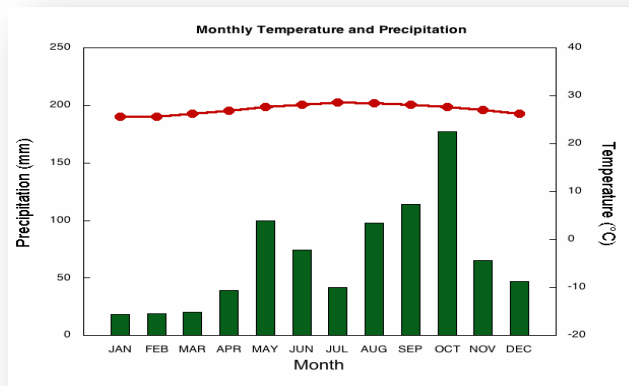
Climate change is about the 'UNPREDICTABLE'!

Jamaica is extremely **climate sensitive**

1 Unpredictable

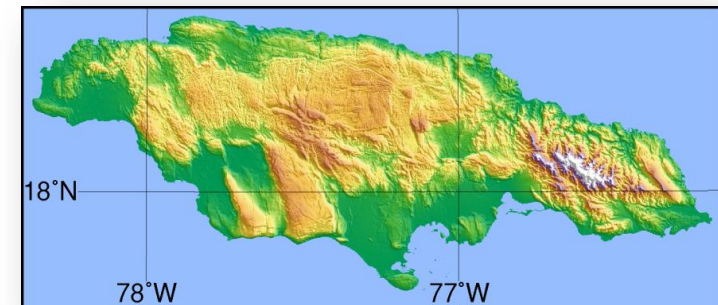
Embedded Climate Patterns

We pattern our lives around climate.



Topography and size

We live on **steep slopes** or on limited **coastal plains**.



Productivity & Quality of Life

Economy (Agriculture, Tourism, Fisheries for e.g.),
Health and Wellbeing (diseases and recreation)
and **Critical livelihood sectors** (Water) bound up with climate



Climate change is about the 'UNPREDICTABLE'!

Jamaica is extremely **climate sensitive**

1

Unpredictable



Jamaica's development is predicated on 'favourable' and predictable climate.



Climate change is making the climate less and less predictable



It is getting harder and harder for climate sensitive sectors in their current form to consistently deliver national growth.

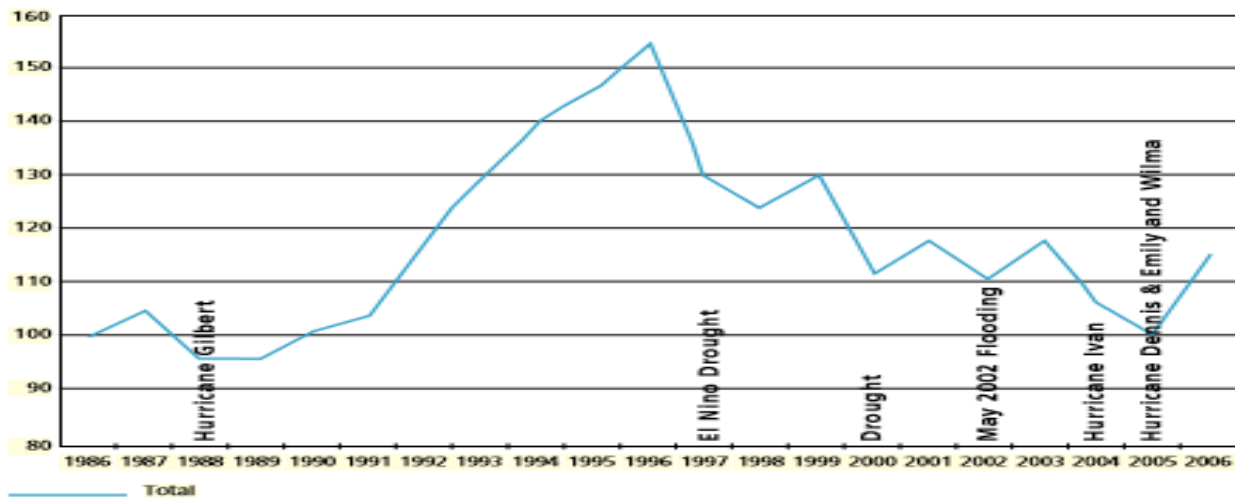
Climate change is about the 'UNPREDICTABLE'!

Jamaica is extremely climate sensitive

1

Unpredictable

Agriculture production index (API) and major events 1986–2006 (1986 = 100)



Source: PIOJ, 2010a.



It is getting harder and harder for climate sensitive sectors in their current form to consistently deliver national growth.

The conversation on Climate Change & National Development



1

Unpredictable



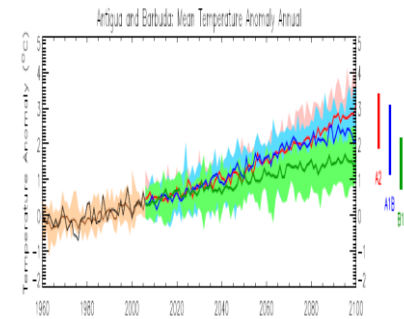
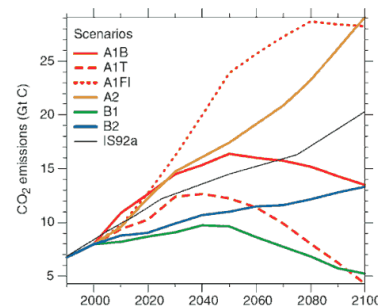
Climate sensitive sectors are becoming 'Unreliable' partners in the pursuit of development

Climate change is about the UNPRECEDENTED!

In the years to come our climate will be a lot different than we now know it!

1
Unpredictable

2
Unprecedented



Models

Scenarios or
Storylines of
future global
development

Future Climate

Temperature
Rainfall
Extremes
Sea Level Rise

Our Climate will change!

The future Caribbean climate will look **a lot different!**

1

Unpredictable



A new era
characterized
by the
unprecedented



The rate at which the
unprecedented is being
ushered in may outstrip the
rate at which the Caribbean
region and Jamaica in
particular can prepare for it.



Challenge of how to contend with the
unfamiliar now while preparing for the
unprecedented to come.

2

Unprecedented

Climate change is about the UNPRECEDENTED!

In the years to come our climate will be a lot different than we now know it!

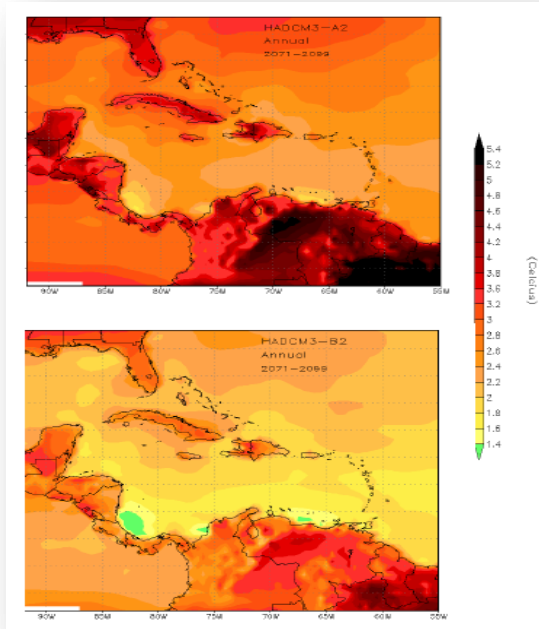
1

Unpredictable

2

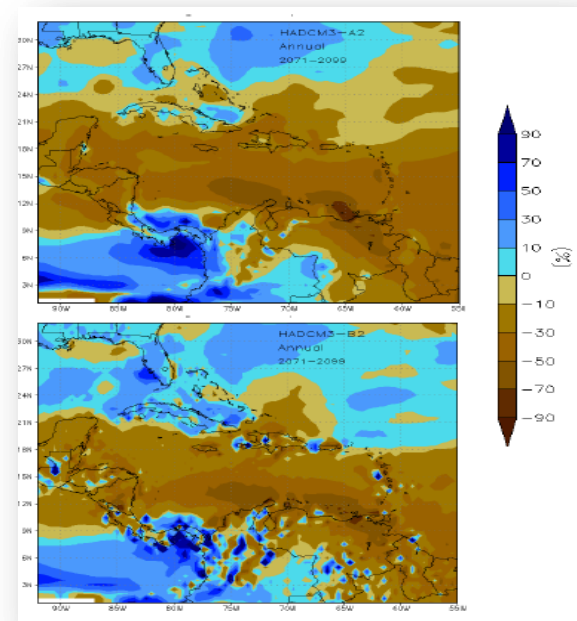
Unprecedented

...even hotter times



- 1-4 degrees by century's end
- 30-98% of days annually will be 'hot' by the 2090s
- Only 2% 'cool' by the 2080s

...even drier conditions



- Still variable but less
- ~30% drier.
- Shorter rainy season
- Longer, more severe droughts

Climate change is about the UNPRECEDENTED!

In the years to come our climate will be a lot different than we now know it!

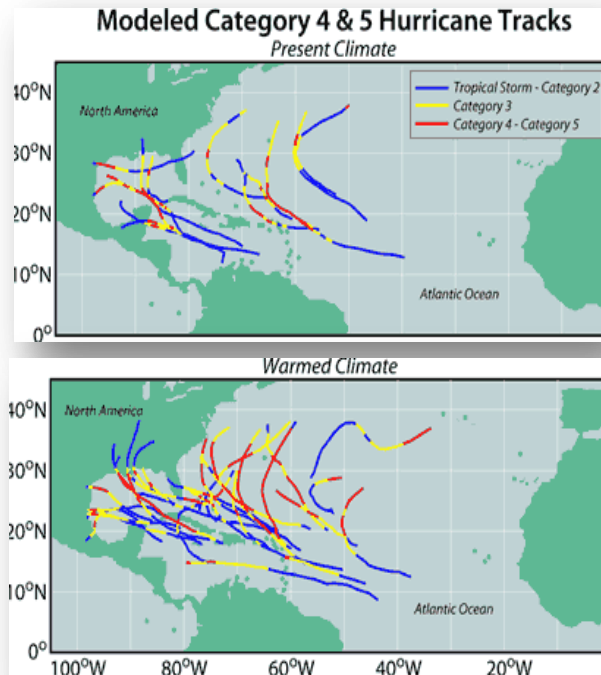
1

Unpredictable

2

Unprecedented

...more intense extremes



Storms, with higher rainfall rates and stronger winds.

...even higher sea levels







Impacts from a 2m SLR on Jamaica
Land area lost (1%). People displaced (1%). Damage or loss to power plants (20%). Tourism resorts damaged or lost (18%). Loss or damage of airports (60%). Loss of roads (2%). Loss or damage to port structures (100%)
- UNDP/CARIBSAVE (2010)

Climate change is about the UNPRECEDENTED!

In the years to come our climate will be a lot different than we now know it!

1
Unpredictable

Already	1 degrees hotter	Variable	More extremes	3.5 mm per year
				
To Come	1-4 degrees hotter	Variable + 30% drier	More Intense extremes	1-2 m sea level rise



Our future will see 'unprecedented' climate change



SO WHAT?

What does this have to do with anything?

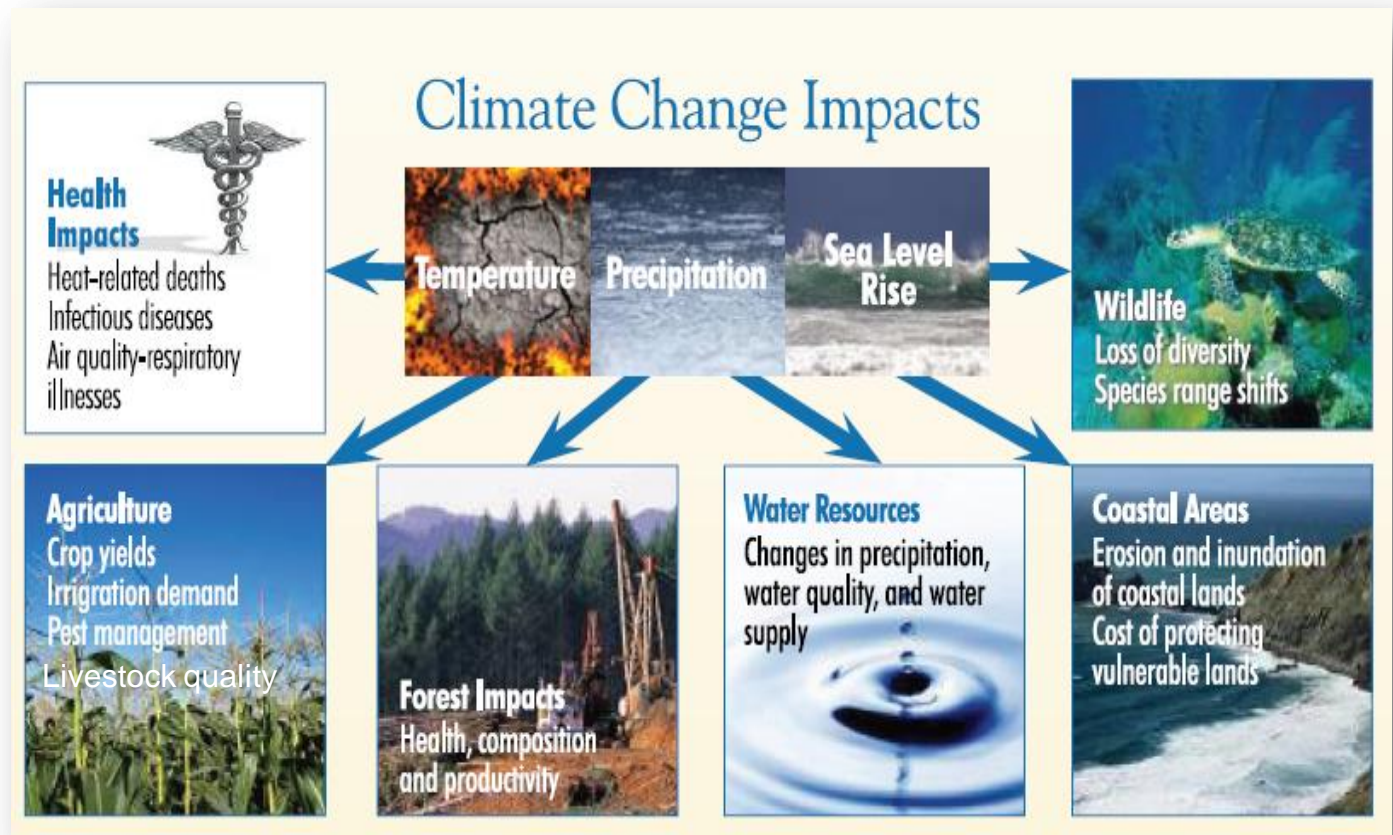
2
Unprecedented

Climate change is about the UNPRECEDENTED!

Unprecedented climate = Unprecedented impacts!!

1
Unpredictable

2
Unprecedented



Our Climate will change!

The future Caribbean climate will look **a lot different!**

1
Unpredictable

2
Unprecedented

Water



We are heading towards a water deficit. **Challenge to deliver safe & adequate water to all.**

Agriculture

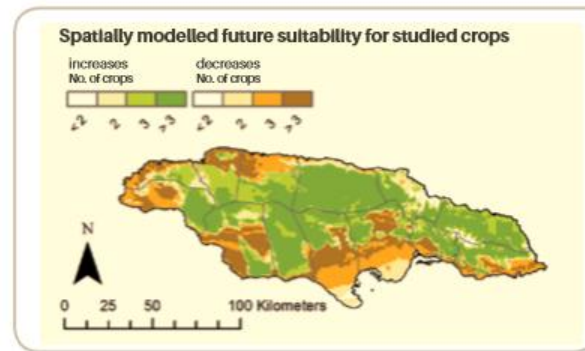


Figure 4 Spatially modelled future suitability of alternative crops in Jamaica, showing areas where most crops have increasing (green colour gradients) or decreasing (orange colour gradients) climate suitability by 2050.

Some areas become less suitable for agriculture. The interior becomes better suited for crops. **Challenge of food security & nutrition.**

Quality of life



Harsher conditions post storms or loss of livelihoods. **Challenge of inadequate social conditions.**

Unprecedented climate = unprecedented impacts!

Our Climate will change!

The future Caribbean climate will look **a lot different!**

1

Unpredictable

2

Unprecedented



Unprecedented climate = unprecedented impacts!

Climate change is about the UNPRECEDENTED!

Unprecedented climate = Unprecedented impacts!!

1
Unpredictable

2
Unprecedented

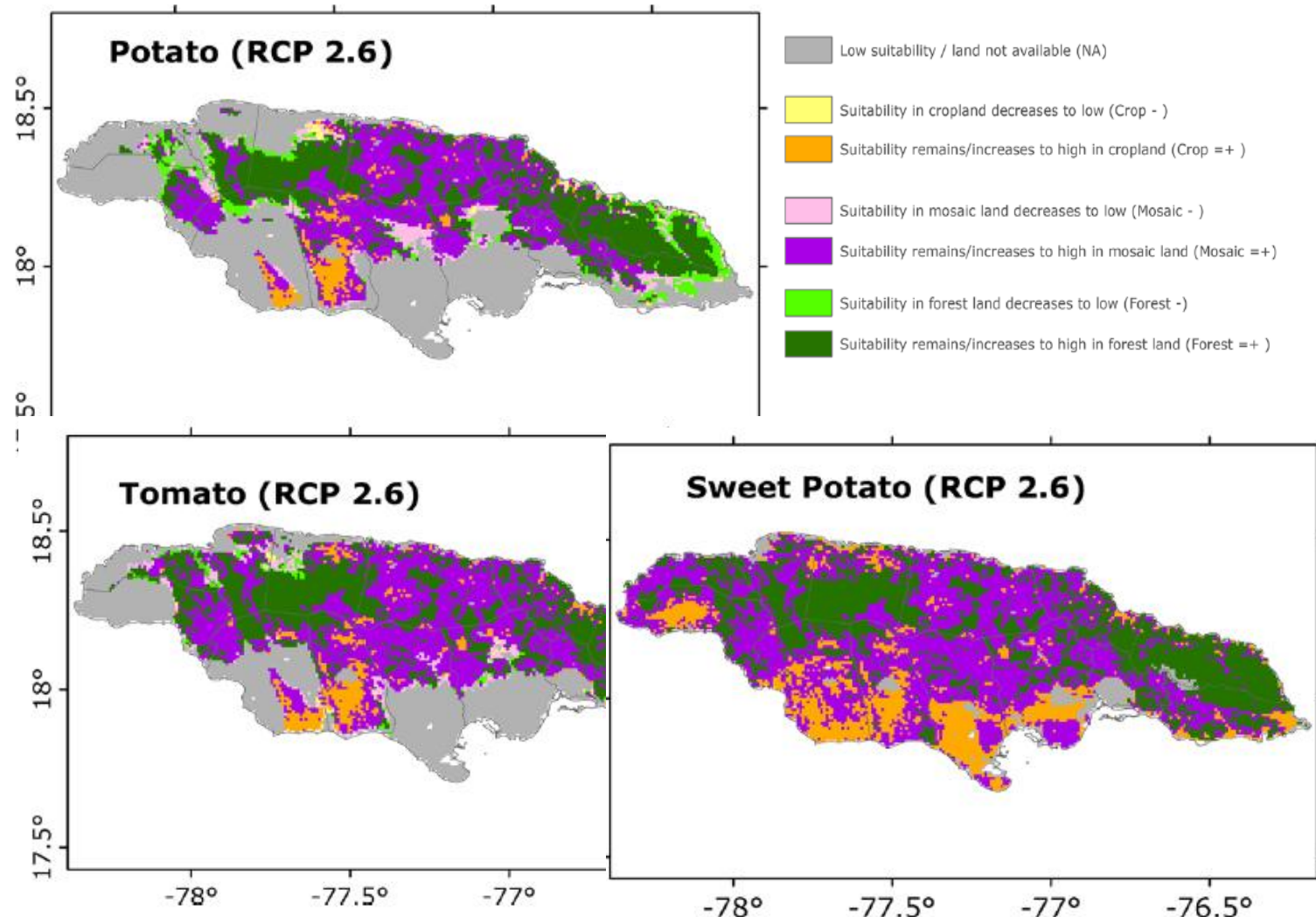


Table 2 Quantified changes between current and future climate conditions of suitable areas for five crops and land use categories. Showing overall suitability for the island, the proportion of highly suitable land in each land use, and the change in suitability for each land use (as shown in Figs. 2 and 3)

Crop	Climate scenario		Suitability ^a		Suitability high by land use				Change in availability ^b						
			High	Low	NA	Crop	Mosaic	Forest	NA	Crop –	Crop =/+	Mosaic –	Mosaic =/+	Forest –	Forest =/+
Common beans	Current	Worldclim	5874	5120	40	362	2712	2760	–	–	–	–	–	–	–
	Future	cmip5	4639	6356	37	324	2205	2073	4852	539	322	51	2189	815	2059
		RCP2.6													
Pigeon pea	Current	Worldclim	7956	3038	458	1487	3610	2275	–	–	–	–	–	–	–
	Future	cmip5	9086	1909	431	1470	4137	2900	2235	64	1455	46	4047	144	2838
		RCP2.6													
Irish potato	Current	Worldclim	10,954	41	466	1676	4914	3734	507	–	1675	–	4913	–	3732
	Future	cmip5													
		RCP8.5													
Sweet potato	Current	Worldclim	6925	4069	80	467	3147	3205	–	–	–	–	–	–	–
	Future	cmip5	5879	5116	57	396	2695	2710	4086	483	382	80	2630	518	2647
		RCP2.6													
Tomato	Current	Worldclim	2425	8570	19	192	1237	978	4134	1914	184	272	1172	2233	918
	Future	cmip5													
		RCP8.5													
Tomato	Current	Worldclim	10,706	288	486	1672	4863	3559	–	–	–	–	–	–	–
	Future	cmip5	10,955	41	444	1676	4914	3735	505	–	1675	–	4914	–	3733
		RCP2.6													
Tomato	Current	Worldclim	10,206	789	320	1255	4744	3763	470	192	1186	488	4722	8	3760
	Future	cmip5													
		RCP8.5													
Tomato	Current	Worldclim	8246	2748	128	662	3853	3570	–	–	–	–	–	–	–
	Future	cmip5	7603	3393	99	547	3501	3398	2771	384	533	118	3428	248	3345
		RCP2.6													
Tomato	Current	Worldclim	4530	6465	33	290	2140	2067	2782	1734	284	365	2071	1606	1986
	Future	cmip5													
		RCP8.5													

Values in square kilometers; NA = low suitability or not available; crop (–) = suitability decreases below 50 in cropland; crop (=+) = remain/increase to above 50 in cropland; mosaic (–) = suitability decreases below 50 in mosaic land; mosaic (=+) = remain/increase to above 50 in mosaic land, forest (–) = suitability decreases below 50 in forest land; forest (=+) = remain/increase to above 50 in forest land

^a Suitability high = suitability index equal or greater than 50, suitability low = suitability index below 50

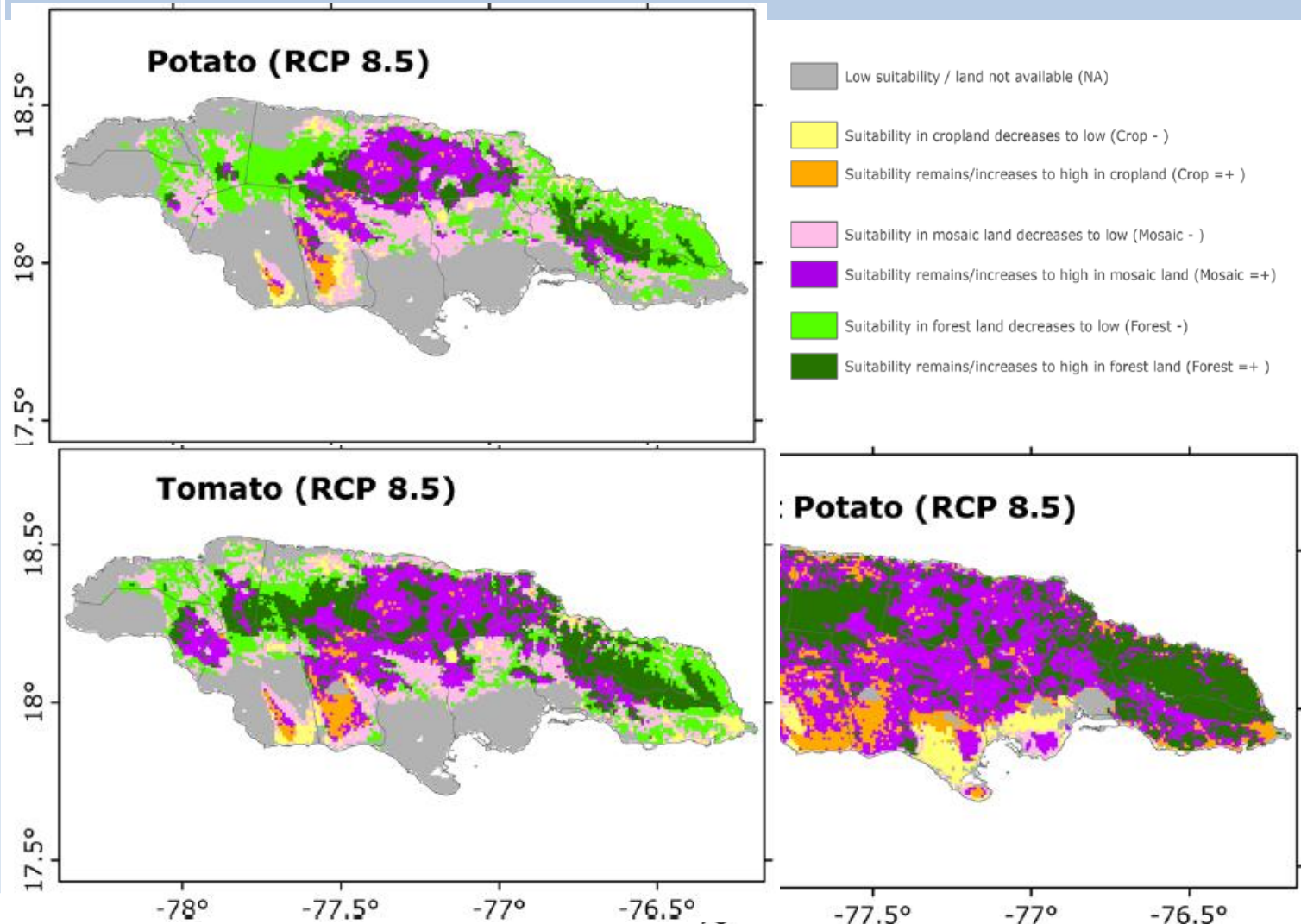
^b Change in availability

Climate change is about the UNPRECEDENTED!

Unprecedented climate = Unprecedented impacts!!

1
Unpredictable

2
Unprecedented



Climate change is about the UNPRECEDENTED!

Unprecedented climate = Unprecedented impacts!!

1
Unpredictable

- Modelling drought tolerance, sweet potato

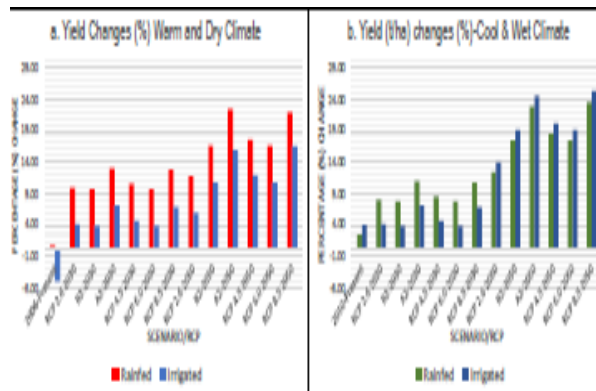


Figure 3. Yield changes (%) in: (a) Warm and Dry Climate, and (b) Cool and Wet Climate, compared to baseline (years with typical climate between 1996 and 2013).

Yields decrease in 'warm and dry', but irrigation and elevated CO₂ enhance yield more than in 'cool and wet' conditions. Irrigation predicted to be unnecessary or counter productive in cool and wet conditions.

- The future of livestock in a warmer climate

3. The Results

THI values for the period 2001-2012 suggest that animals in ambient field conditions in the three agro-ecological zones in Jamaica experience considerable periods of heat stress year round, particularly in the summer months (see Figure 2 and table 1). A linear increase is noted in THI over the period 1960-2009, with only minor variations among ensemble members. At the warming threshold of 1.5°C, the projected increase puts this stress at danger of severe levels for most (layers and pigs) or all (broilers and ruminants) of the year (Figure 3); the higher warming thresholds progressively exacerbate the impact.

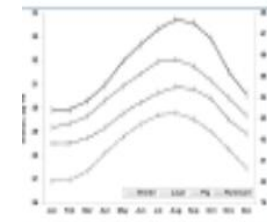


Figure 2. Observed mean monthly THI for chickens (broilers and layers), pigs and ruminants (2001-2012) mean (± standard error) of three locations in Jamaica.

Table 1. THI values to classify levels of heat stress for ruminants, chickens and pigs (Adapted from Hake et al. 2009, Hake et al. 2009).

	THI values for heat stress		
	none	increasing	very severe
Ruminants	≥ 74	75 - 83	≤ 84
Chickens, Pigs	≥ 27	28 - 29	≤ 30

4. Conclusion

The warming of 1.5°C is a critical threshold at and beyond which excessive heat stress will be experienced by all livestock.

The threshold of 1.5°C is attained between 2019 and 2043, depending on model (with a mean occurrence of 2023).

Remedial measures are needed to prevent adverse impacts to the livestock industry as well as food and nutrition security in the Caribbean.

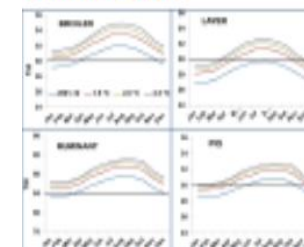


Figure 3. Future mean monthly THI for global warming steps of 1.5°C, 1.8°C and 2.5°C. Blue curves represent present day and red/orange curves represent the future. The red/orange curves represent the future. The red/orange curves represent the future.

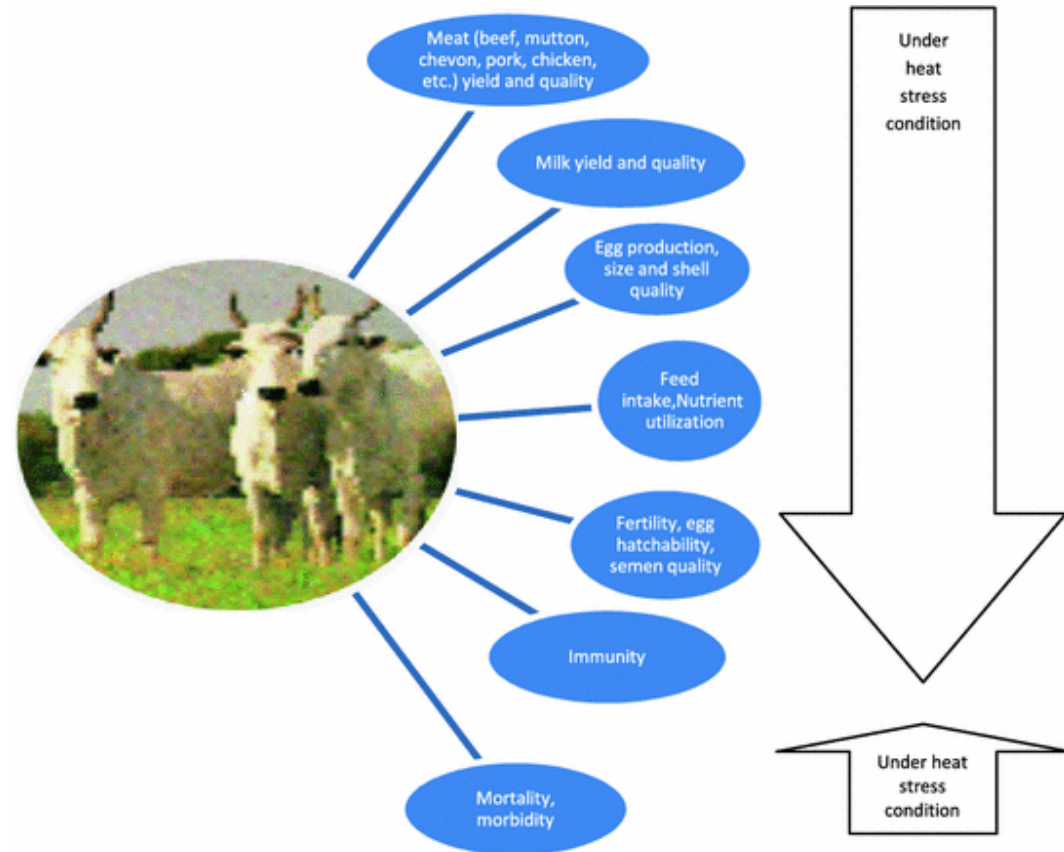
Climate change is about the UNPRECEDENTED!

Unprecedented climate = Unprecedented impacts!!

1
Unpredictable

2
Unprecedented

Heat stress could affect animal production and well-being, especially because of increase in air temperature. Heat stress is very common and on the increase particularly in the countries like Jamaica. There is considerable research evidence that shows significant decline in animal performance when subjected to heat stress



Climate change is about the UNPRECEDENTED!

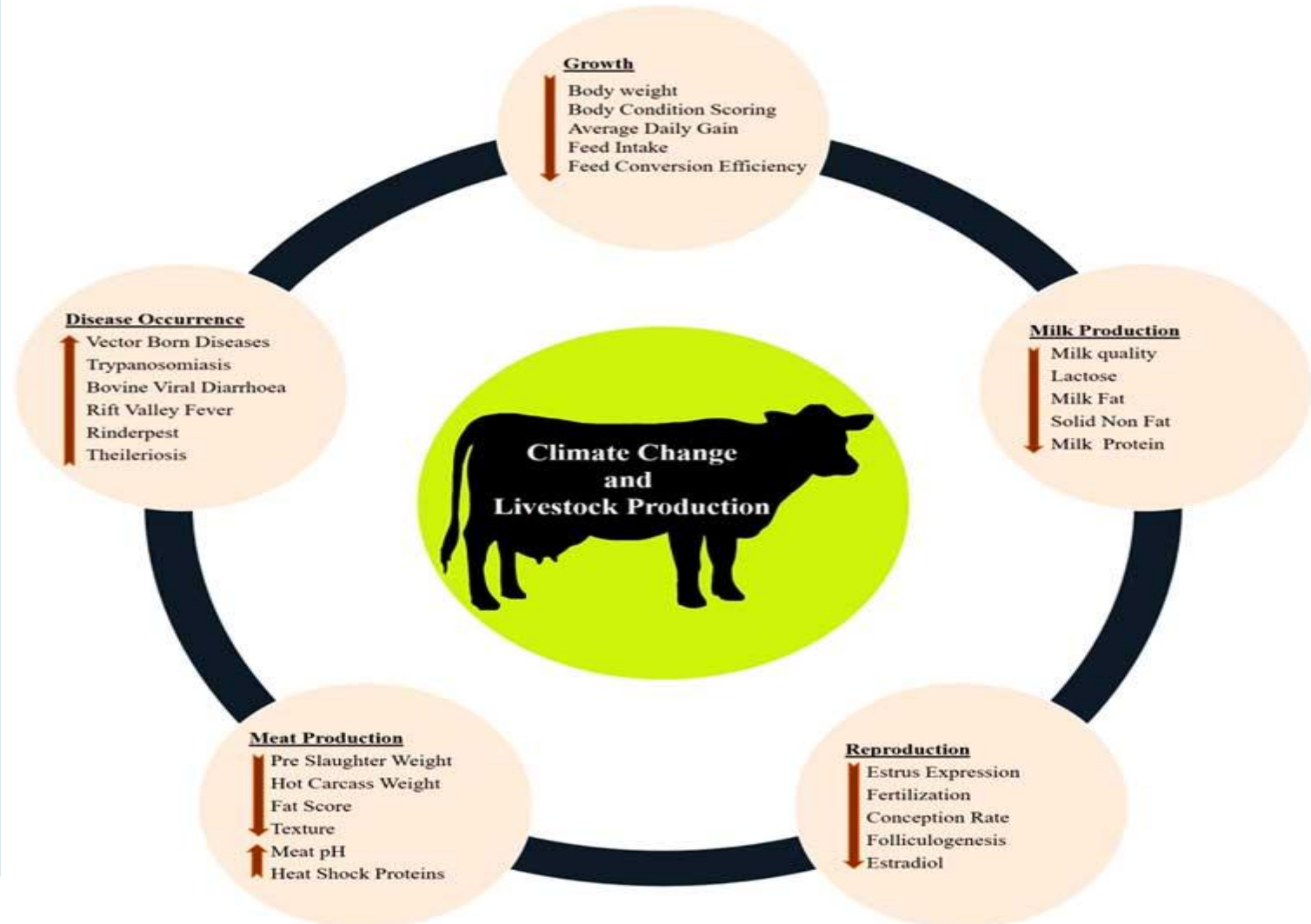
Unprecedented climate = Unprecedented impacts!!

1

Unpredictable

2

Unprecedented



Climate change is about the UNPRECEDENTED!

Unprecedented climate = Unprecedented impacts!!

1

Unpredictable

Coastal infrastructure & livelihoods



2

Unprecedented



Health



Increasing challenge to deliver adequate health care in an already over-burdened system.

Climate change is about the UNPRECEDENTED!

Unprecedented climate = Unprecedented impacts!!

1

Unpredictable



Jamaica's future developmental targets will be seriously challenged by future climate change.

2

Unprecedented



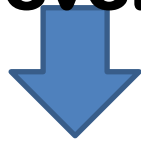
Climate change will bring about unprecedented impacts



It will get even harder for climate sensitive sectors (if they remain in their current form) to meet production targets and deliver on national growth.

The dialogue on Climate Change, Important sectors and National Development

1



Unpredictable



Climate sensitive sectors are becoming '**Unreliable**' partners in the pursuit of growth and development



2

Unprecedented



Climate sensitive sectors will become '**Unproductive**' partners in the pursuit of growth and development

Climate change is about URGENT action!

WHO?

- 1
Unpredictable
- 2
Unprecedented
- 3
Urgent



WHY?

We can't know what we know and still allow climate change to derail Jamaica's growth and its economic development. We can chart the future we want if we **ACT NOW!** In fact, we are in a climate emergency

Our Climate demands change!

Our climate demands we do something **urgently!**

1
Unpredictable



Change in
our attitude to
climate
(‘Take notice’)



Change in our
approach to
development planning
(‘Take Account’)



Change in how we act with respect
to climate (‘Take action now’)

2
Unprecedented

3
Urgent

Climate change is about URGENT action!

WHAT?

Mitigation

‘...changing so we reduce the amount of greenhouse gases we put in the atmosphere’

Energy



Waste



Forests



Adaptation

‘...changing in order that we and others can live with the changed climate’

Farming practices



Sea walls



Water harvesting



Policies & programmes



Education

‘...engendering behavioral change’



**Conscious,
convinced &
convicted
about the
issue**

Our Climate demands that we change!

WHAT?

Mitigation

‘...changing so we reduce the amount of greenhouse gases we put in the atmosphere’

Adaptation

‘...changing in order that we and others can live with the changed climate’

Education

‘...engendering behavioral change’



Reducing emissions through:

Land management
Livestock management
Soil management
Restoration of degraded land
Reducing post-harvest food loss
Use of renewables
Transportation efficiencies



Adapt by:

Diversification of agricultural practices;
Irrigation and drought management;
Research;
Early warning & climate services;
Technology;
Better saving, lending & insurance mechanisms for farmers;
Better forest-conversation practices.
Making informed decisions on where to build and how to build



These kind of actions will build climate resilient, low carbon sectors to climate change

1

Unpredictable

2

Unprecedented

3

Urgent

The conversation on Climate Change & National Development

1
Unpredictable



Unpredictable



Climate sensitive sectors are becoming '**Unreliable**' partners in the pursuit of development

2
Unprecedented



Unprecedented



Climate sensitive sectors will become '**Unproductive**' partners in the pursuit of development

3
Urgent



Urgent



Climate sensitive sectors will become '**Undeniable**' partners in the pursuit of development

For Reference.....





THANK YOU FOR YOUR ATTENTION!!

Dr. Alicia A. Hayman
Email: aliciahayman@gmail.com