

Vulnerability of homegarden Systems to climate change and its impact on food security in South Asia



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Asia-Pacific Network for Global Change Research

“Vulnerability of Homegarden Eco-Systems to Climate Change and Its Impacts on Food Security in South Asia”

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Climate change in Sri Lanka



- Slow & continuous rise of ambient temperature (0.01 – 0.03 °C per year)
- Frequent occurrence of extreme weather events
 - Droughts & floods : **increased**
 - High intensity rains – Land slides : **increased**
 - Tornado type winds : **increased**
 - Intense lightning strikes : **increased**
 - Total number of dry days : **increased**
 - Warm days : **increased**
 - Number of cold nights/comfort nights : **decreased**

Marambe et al. (2012, 2013, 2015), Punyawardena et al (2010, 2013,) , Punyawardena and Premalal (2013)

Justification

- Climate Change
- Extreme weather events
- Wet areas getting wetter and dry areas getting drier
- Serious implications for food production
- South Asian Agriculture – mostly affected with a large number of small farmers of which majority live under poverty.
- Sri Lanka, India and Bangladesh - highly exposed and highly sensitive to climate change (ADB, 2009)
- A significant component of the small holdings in the region is represented by **HG farming** systems
- In 2014, about 14.3% of the total extent of the country has been occupied by HGs, which has continued to grow at an annual rate of 1.6%.

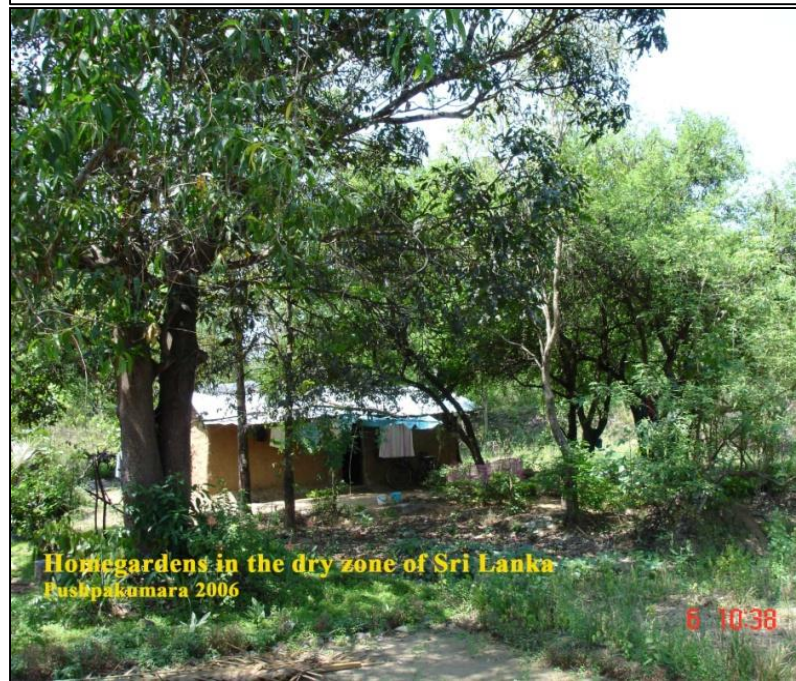
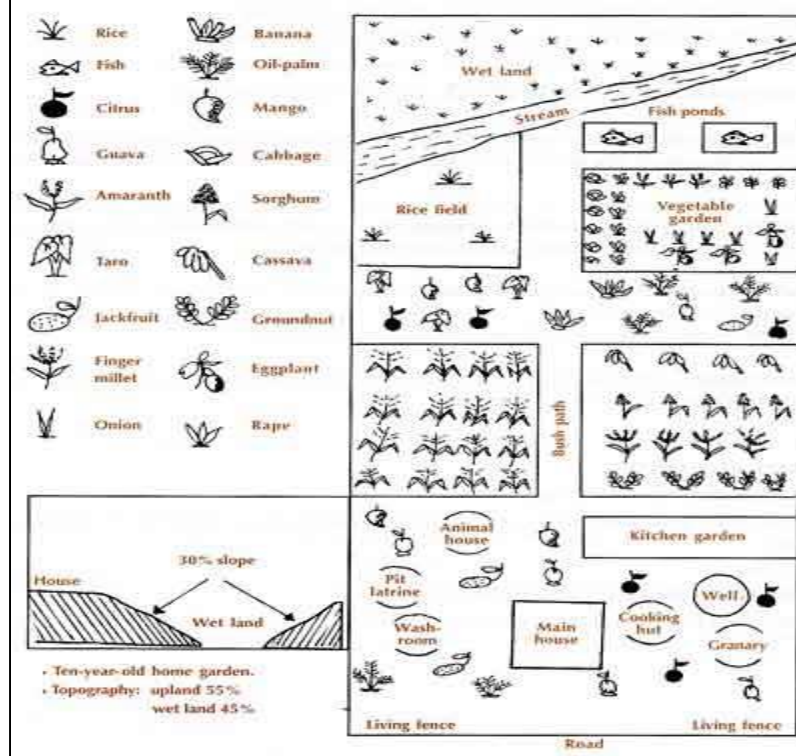


Homegarden (HG)

“a complex sustainable land use system that combines multiple farming components of the homestead, and provides environmental services, household needs, and employment and income generation opportunities to the households”.

(such as annual and perennial crops, livestock and occasionally fish)

(Weerahewa et al 2012)



Homegardens and Food Security

- Homegardening would increase crop production during adverse climate conditions (UNFCCC, 2008)
- Food security in rural South Asia and food production in HGs is intrinsically related and hence, climate change may have significant implications on food security (Marambe et al, 2012; Pushpakumara et al, 2012)





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Objective

- To assess the changes in the composition of HGs in selected villages in Sri Lanka, Bangladesh and India under a variable and changing climate and its impact on household food security

23-24 November 2009





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14-15 September 2010



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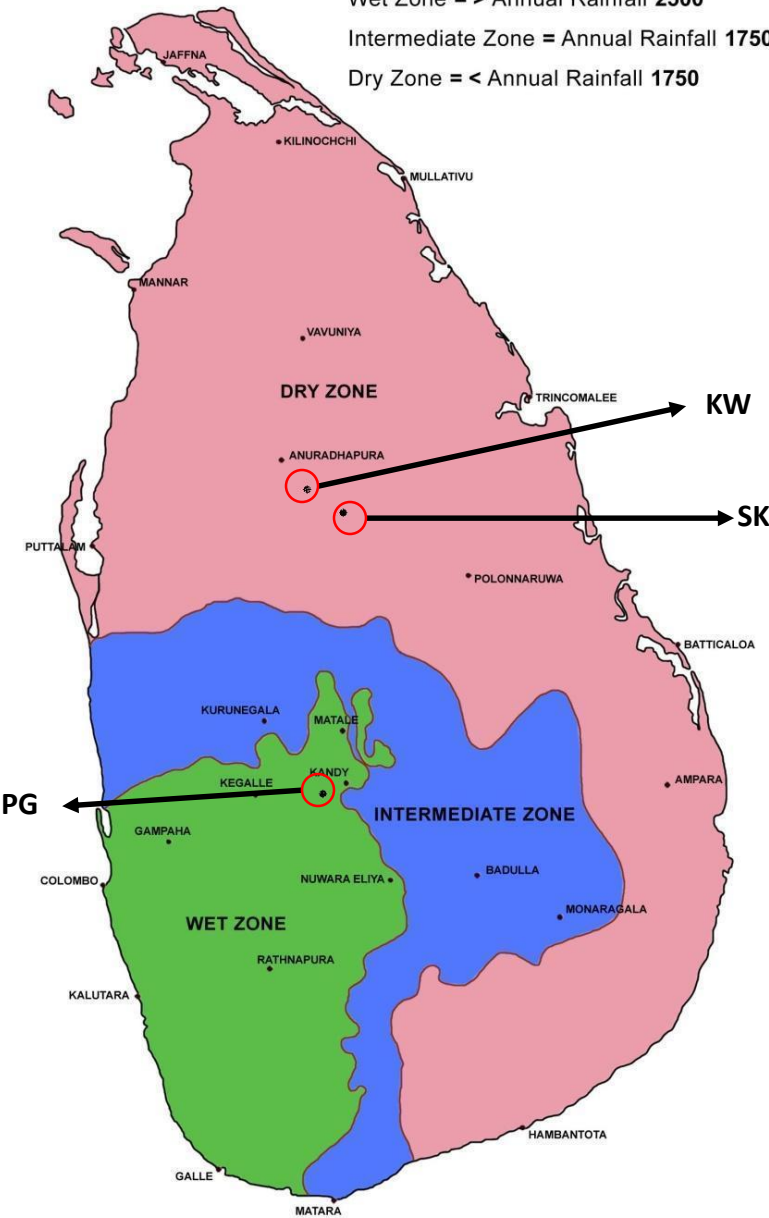
15-16 June 2011



Climatic zones of Sri Lanka with locations of the study

Study sites

Wet Zone => Annual Rainfall 2500
Intermediate Zone = Annual Rainfall 1750 - 2500
Dry Zone =< Annual Rainfall 1750



Number of households surveyed

- Keeriyagaswewa – 59
- Siwalakulama – 30
- Pethiyagoda – 59



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Study Sites

India – West engal

Name of the villages	Climate Zone	Number of Households Surveyed	GPS position
Ledagamar	Sub Humid	74	Lat: 22.833 Long: 87.323
Keshia		26	Lat: 22.804 Long: 87.329



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Study Sites

Bangladesh

Name of the villages	Climate Zone	Number of Households Surveyed	GPS position
Borjona-bd	Subtropical Monsoon Region (Central south zone at country perspective)	20	24.3 ⁰ -24.16 ⁰ N 90.3 ⁰ – 90.42 ⁰ E
Nakasini-bd		20	
Koroli-bd		20	
Goshaigao-bd		20	
Tatulia-bd		20	
Charbaria-bd		20	



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Data collection

- Historical Climate data – Met. Department
 - Trend analysis (av. annual min & max temperatures and annual rainfall) for the entire data set of 50 years (1961 to 2010).
- Household Survey – Questionnaire
 - Changes made to the HGs during the past 20 years and on adaptation strategies.
 - Changes made in HGs during the past 20 years with regard to crops, woody trees, naturally grown plants, and domestic animals.

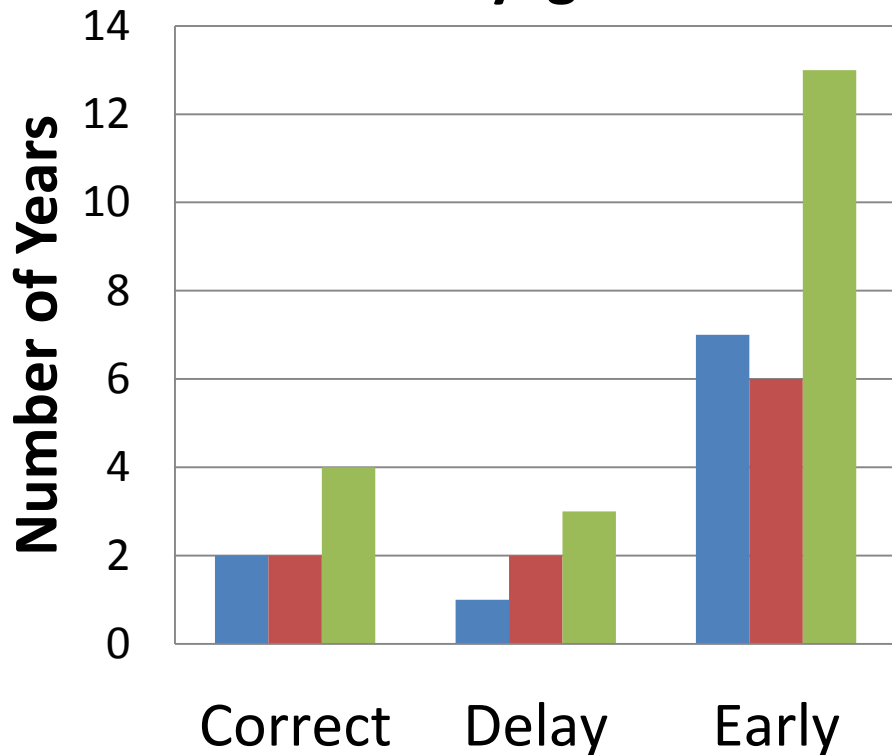
Vulnerability Assessments of HGs

- food consumption pattern (dependence on HG vs. market)
- plant and animal species composition
- ecological information
- production from plants and animals
- diseases outbreaks
- shift of flowering and fruiting
- adjustment to cultivation practices, and
- marketing information

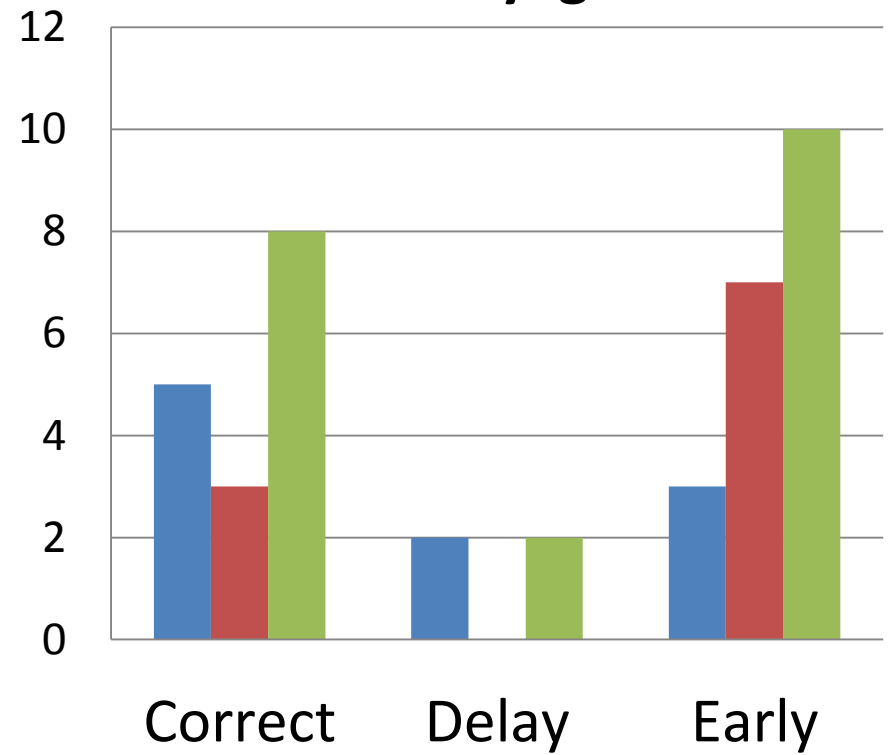
Onset of Rains

1991-2000 2001-2010 1991-2010

Onset of *Maha* season - Pethiyagoda



Onset of *Yala* season - Pethiyagoda

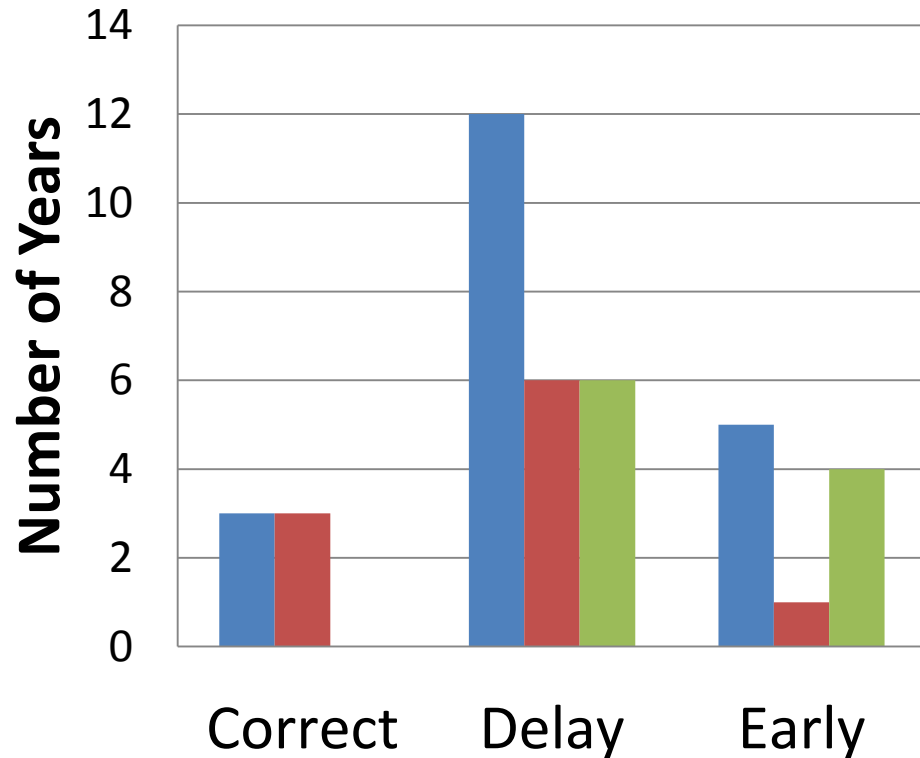


the *Maha* and *Yala* season has started early in the majority of occasions (1991-2010)

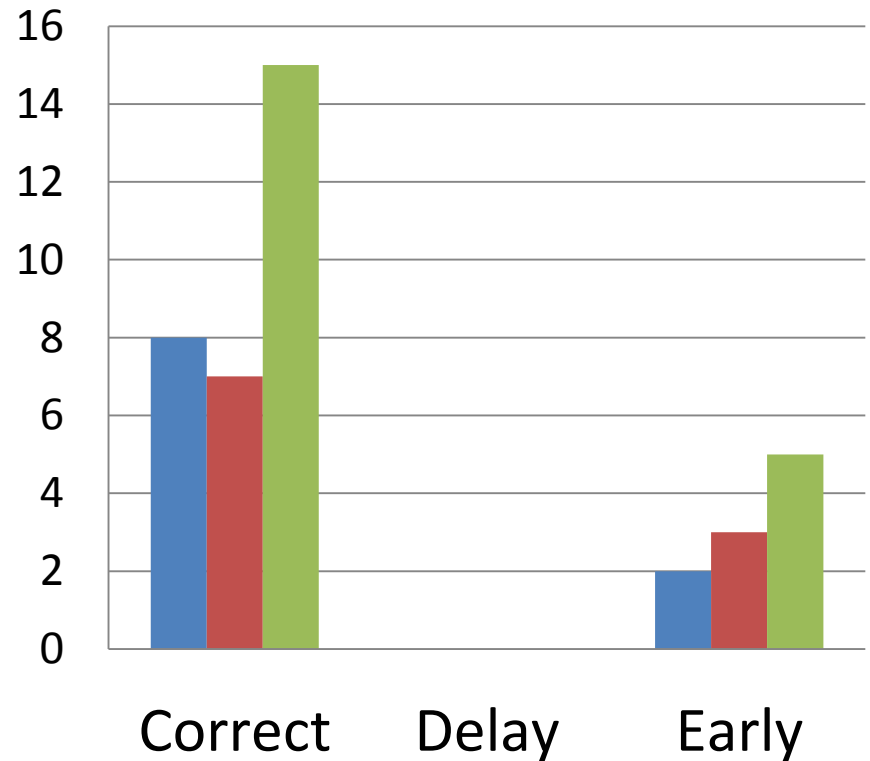
Onset of Rains – LCDZ

1991-2000 2001-2010 1991-2010

Onset of *Maha* season - Keeriyagaswewa



Onset *Yala* season - Keeriyagaswewa



the *Maha* season has not been set on time in 85 % of the occasions (1991-2010)

the *Yala* season has mostly set on time (1991-2010)

Adaptation Strategies

- The specific adaptation strategies used by the home gardeners in the study sites were
 - (a) changing planting date
 - (b) changing agronomic practices such as fertilization, and pest control
 - (c) changing technology such as use of new varieties/breeds, irrigation, etc.
 - (d) use of soil and water conservation measures

Food Security – HGs

- The HGs were occupied by more nutritional and dense stands of tree species.
- In Sri Lanka, Cloves, Nutmeg and Durian are the main income generator where 87-100% of the harvest is sold



Conclusions – Comparison of Countries

- **Sri Lanka** – bimodel rainfall pattern (North east and South west monsoons)
- **Bangladesh and India** – Unimodel rainfall distribution (only South – west monsoon is effective)
- **Sri Lanka sites** (*two cultivating seasons*)
Yala (March to August) and *Maha* (September to February)
- **Bangladesh site** (*two cultivating seasons*)
Kharif I (mid March to mid July) and *Kharif II* (mid July - mid Oct)
- **India site** (one major agriculture season)
Kharif (July to October)

(farmers in Bangladesh have opted to make use of the non-monsoonal stormy rains received during mid-March to early or mid-July from the Western disturbances as *Kharif 1* growing season).

Conclusions – Comparison of Countries

- The rate of rise in night-time minimum temperature was more pronounced than the daytime maximum temperature in all study sites during 1961-2010
- The onset of cultivating seasons and seasonal rainfall have varied considerably ($p < 0.05$) during 1991-2010 within and among the study sites.
- The homegardeners who perceived changes in climate were more adaptable to climate changes.

Conclusions – Comparison of Countries

- Only 18% HGs in Sri Lankan sites had crops-farm animals integration (at least one breed of cattle)
- 85% HGs in Bangladesh site and 63% HGs in Indian site comprised of at least two species of farm animals in addition to crops.





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