

# **Vulnerability of Addis Ababa to Climate Change impact**

**(methodological issues & early  
results)**

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# Outline

1. Background
2. Objectives
3. Methodological issue
4. climate change
5. impacts of climate change
6. most vulnerable areas/community of AA
7. Vulnerability of AA

# 1. Background

- World consensus on causes for and impacts of climate change (CC).
- Focus on adaptation and mitigation
- Urban vulnerability to cc impact:
  1. Urbanization
  2. Low quality of lives
  3. Strong rural-urban linkage
  4. CC is distant problem for many, affect measures to adaptation.

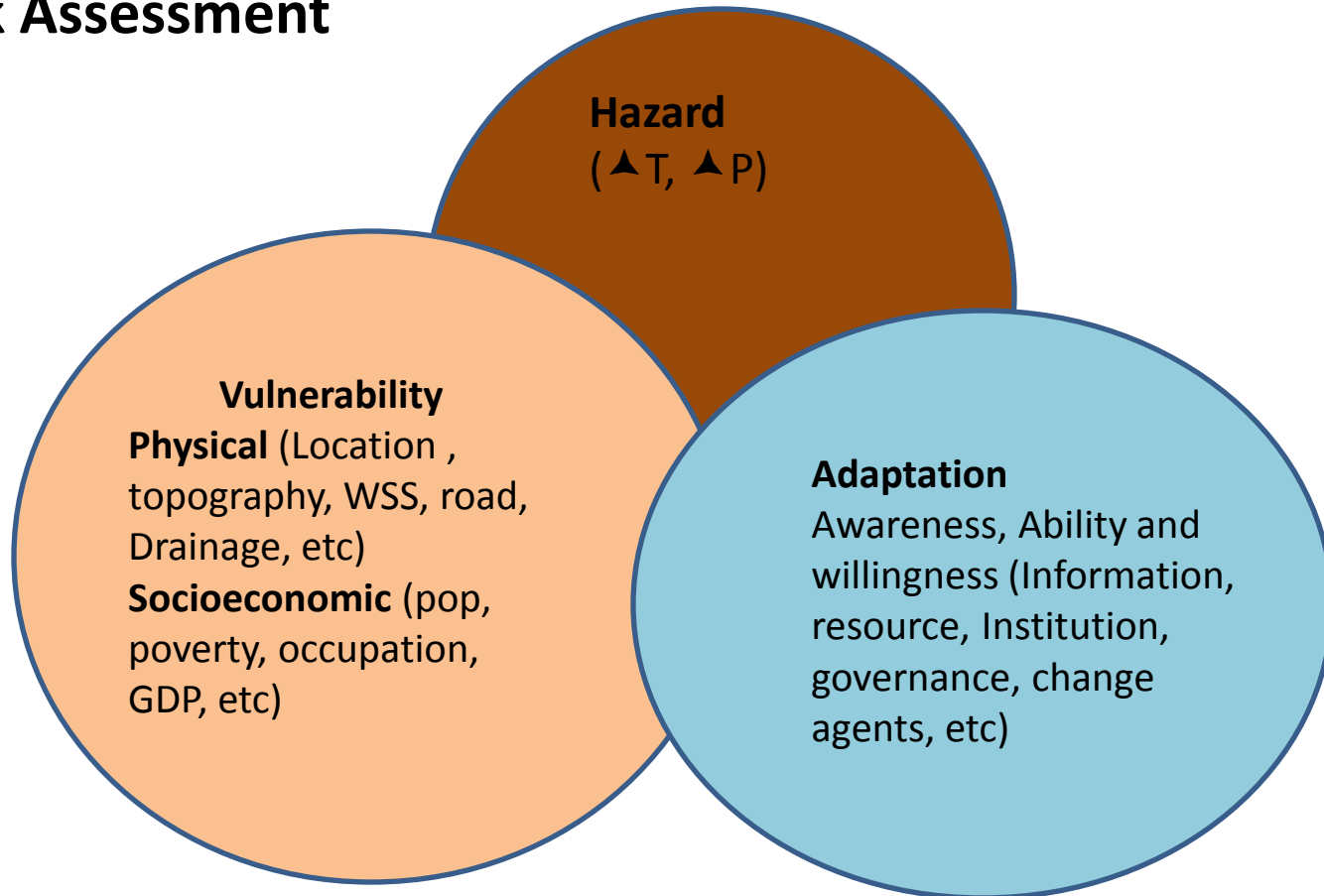
## **2. Objective**

- **General;**
  - Assess the vulnerability and adaptation capacity of AA to water mediated climate change.
- **Specific;**
  - Assess the extent of vulnerability of the city;
  - Identify the most vulnerable areas/community in AA
  - Assess the adaptation capacity of the city
  - Propose policy and institutional options to build the adaptation capacity of the city to WMCCI.

# 3. Methodology

## 3.1. Conceptual Framework

- **Climate studies:** Hazard, Planners & Policy makers; and Economic Analysis
- **Risk Assessment**

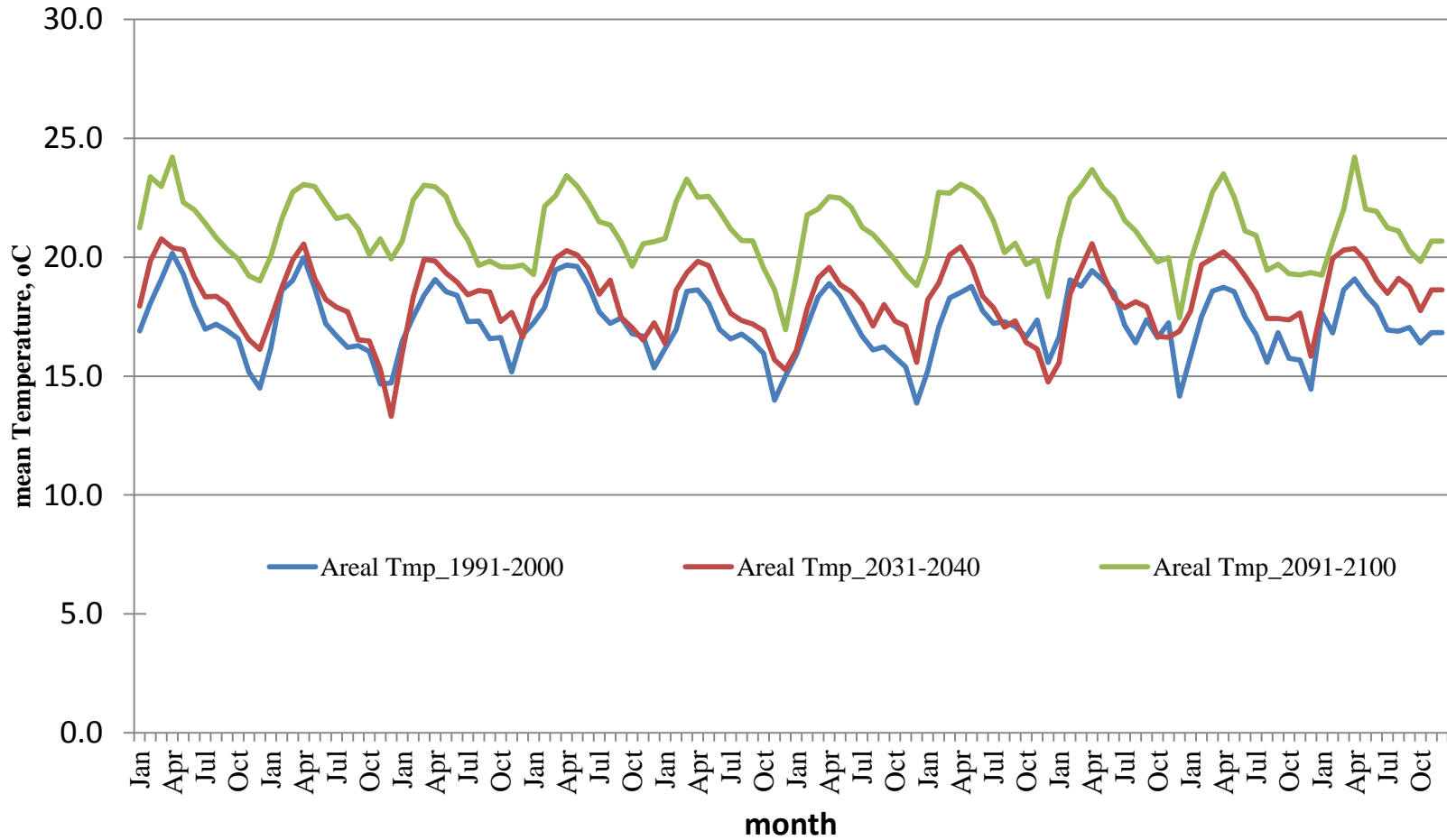


## 3.2. Data

- Review of reports, previous studies, etc
- Qualitative: FGD, Key Informant Interview, physical observation
- **Aim of FGD:**
  - awareness level: knowledge and preparedness to adaptation
  - Perception on change in T & RF within the last 20 – 30 years compared the years before & future anticipation on the same
  - Adverse effects/impacts & extent of damage
  - Adaptation mechanisms so far adopted that need to be strengthened.
- **Participants of FGD:**
  - # of years live in the village (>20 yrs), gender, social & economic status.
- **Criteria for selection of most vulnerable community/areas**
  - Flood (40%)
  - Water supply and sanitation (50%)
  - Economic Status (10%)

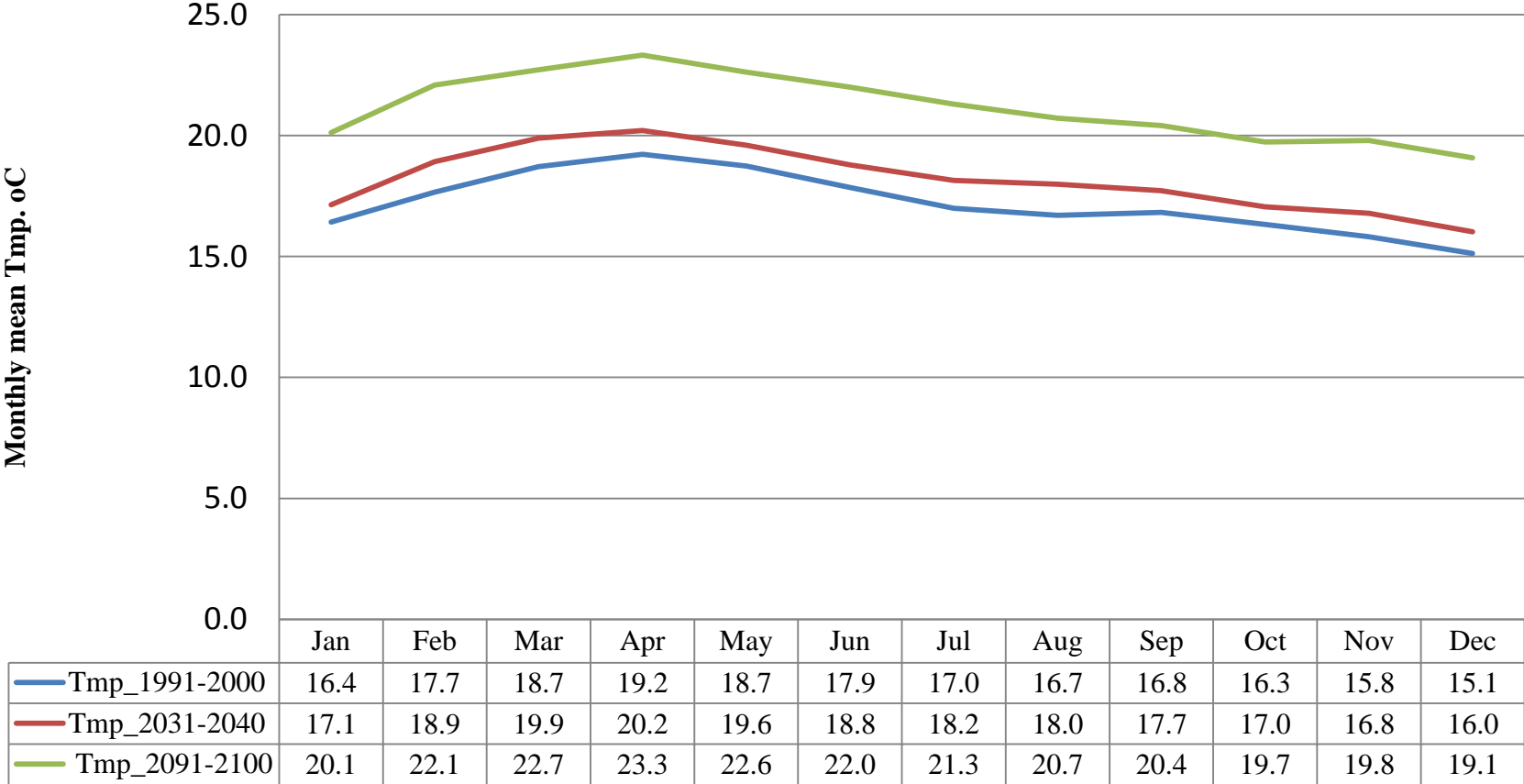
# 4. Climate variability

## Temperature



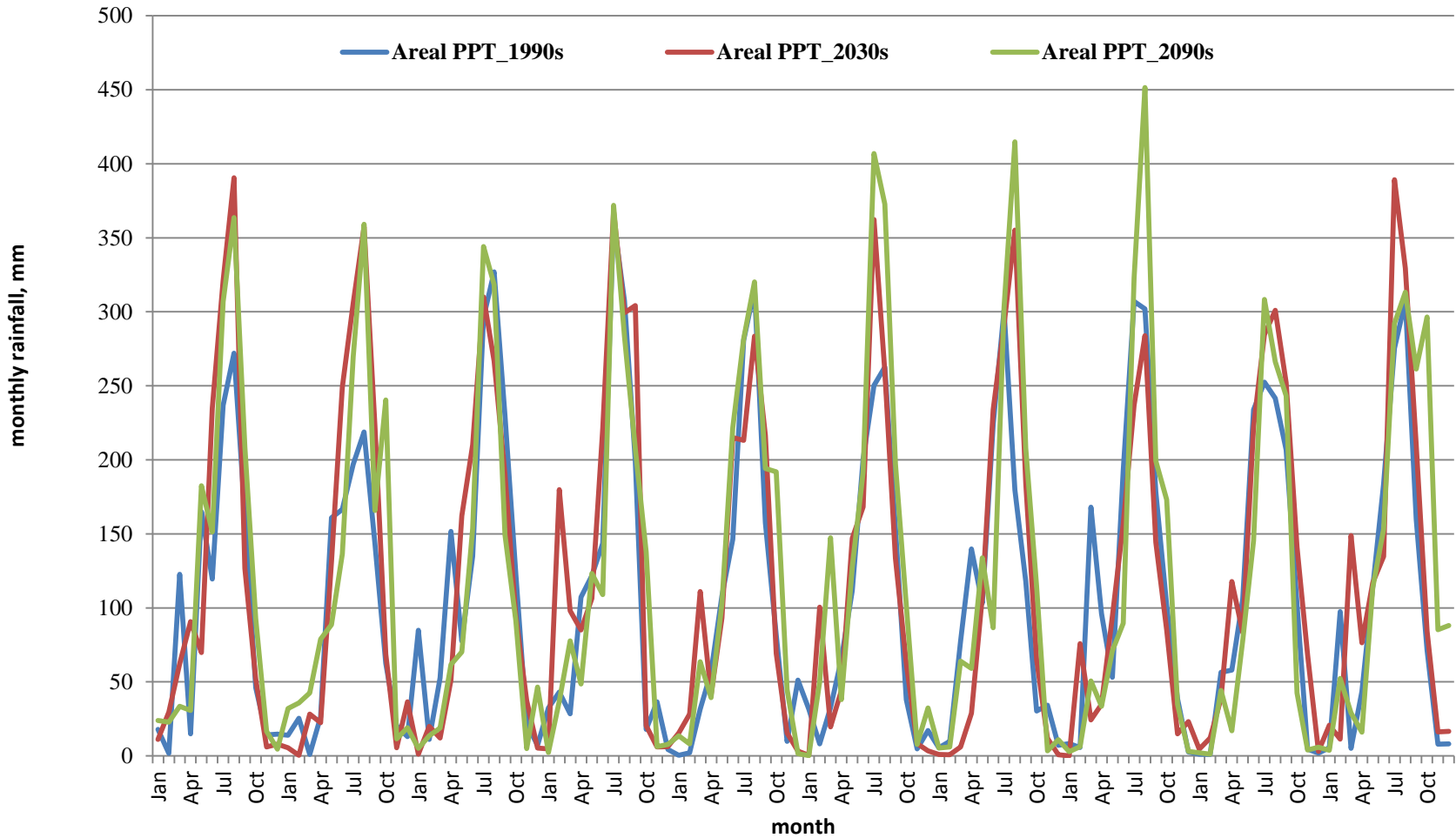
# Projected seasonal variation in Temperature

Figure 4: Temperature scenario in 1990's, 2030's and 2090's

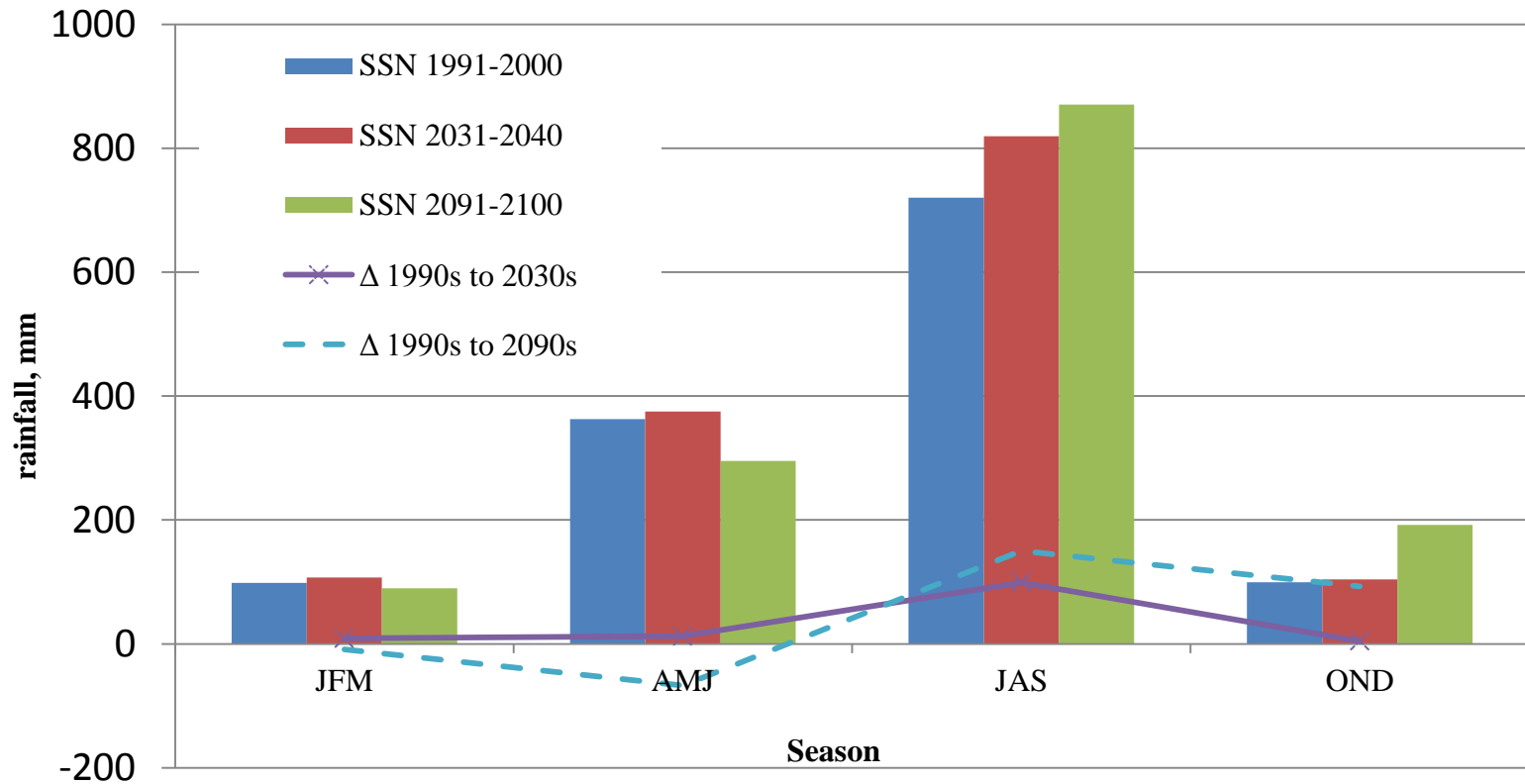




# Projected change in average annual precipitation



# Projected change in seasonal precipitation



## **5. Impacts of climate change (city and household levels)**

- **increase in Riverine flood volume**
  - Street flood
- **increase water demand (Water shortage)**
  - increase wastewater generation??  
Pollution of Akaki river increase
  - + likely increase in water availability

## 6. Most Vulnerable Areas/community in AA

	Ad.Ke	Lid	Arad	Bol	Yek	N.Si	Kolf	Gul	Cher	Akk
<b>1. Flood (40%)</b>	20	40	40	0	20	40	20	20	40	40
Frequency of flood	1	2+	2	0	1	2	1	1	2	2+
Extent of damage	yes	yes	yes	-	yes	yes	yes	yes	yes	yes
<b>2. Water supply and sanitation</b>	<b>33.1</b>	<b>27.4</b>	<b>39.9</b>	<b>17.2</b>	<b>27.8</b>	<b>20.6</b>	<b>33.1</b>	<b>39.9</b>	<b>31.2</b>	<b>37.5</b>
<b>Access to WS (25%)</b> - Service type, frequency of interruption	25	12.5	25	9.1	9.1	12.5	25	25	12.5	12.5
<b>Access to sanitation (25%)</b> - type of toilet service	8.1	14.9	14.9	8.1	18.7	8.1	8.1	14.1	18.7	25
<b>3. Economic Status (10%)</b>	<b>6.57</b>	<b>8.74</b>	<b>5.77</b>	<b>4.90</b>	<b>7.11</b>	<b>9.48</b>	<b>7.34</b>	<b>7.14</b>	<b>5.74</b>	<b>9.81</b>
Housing condition	4.6	4.6	4.5	3.9	4.8	4.5	4.5	4.5	4.5	5
Having Saving Account	1.9	4.1	1.2	0.9	2.2	5	2.3	2.6	1.2	4.8
<b>Total</b>	59.6	<b>76.2</b>	<b>85.7</b>	22.1	54.9	<b>70.0</b>	60.4	67.1	<b>76.9</b>	<b>87.3</b>

# 7. Vulnerability of Addis Ababa

## 7.1. . Socioeconomic vulnerability of AA

### A. Urbanization

- ✓ **Population:** high growth rate, high density; migration contributed 46.9%;
- ✓ **Physical areas expansion:** High rate of horizontal expansion: unplanned, & not well managed, resulted in squatter development.
- **Implication to vulnerability:** more people exposed, more sensitive, makes adaptation too costly.

Population growth		
Period	Pop. #	%
Menilek-II	100,000	
1984	1,423,111	14.23
1994	2,112,737	1.48
2007	2,738,248	1.29

Physical expansion in hectare (built areas in the plan)		
Period	Total built area (ha)	Expansion (ha)
1886 - 1936	1863	
1937 - 1975	6050	4186
1976 - 2000	14672.7	8622.7

# 7. Vulnerability ...

## B. Housing situation:

- ✓ 20% of houses built between 1984 – 1994 are built by **squatters**;
- ✓ **80% of the city's population live in slums** (overcrowded, poor quality houses, unhygienic, informal settlement, etc)

- ✓ 46% of the housing stock are **state-owned**;

of these, 24.8% are in a very poor conditions

- ✓ Rental accommodation amounts to 60% of the housing stock, most of which are built **without official permit**
- ✓ Given the current population growth rate, the city should be able to provide **60,000 houses annually**.

- ❖ **Vulnerability Implications:** more exposed (# houses & people) and easily sensitive to water-mediated cc impacts, otherwise makes adaptation costly.



## c. Economic status

- **Sources of income:** low & unreliable sources.
- ✓ 98% of HHs have some form of income but abysmally low by international standard
- ✓ **Salary:** 42.8% comes from from GO & NGO & others
- ✓ **Self employment:** 40.1%
- ✓ **Remittance:** 7.2%
- **Economic activity:** 60% of the total economy is characterized by informal activities.
- **Unemployment:**
  - ✓ though decreased, still higher & gender biased
- **Poverty:**
  - ✓ still high though declined.

**Trends in Unemployment rate by sex**

year	Male	female	Total
2003	21.2	43.7	32
2005	22.8	40	31.4
2009	18.4	38.3	27.9

**Trends in poverty incidence & gap**

Years	Poverty index (%)	Poverty gap (%)
1995/96	30.2	8.7
1999/2000	36.1	9.6
2004/05	32.5	6.3
Change (%) ('95 – 04/05)	7.7	-27.4

# Economic status:

## d. urban and peri-urban agri.

- Urban and peri-urban agriculture using Akaki rivers practice since 1940s
- >90% of the farms are irrigated with polluted water of Akaki river
- >61% of vegetable (lettuce & root) supplied to AA city
- A number of HHs engaged in the production and supply chain of UA.
- **Implication:** livelihoods of HHs exposed to CC impacts & city's supply of veg. decreased and higher price for veg.

Farm site	Farmer s, #	Land size, ha	Prod. (qt)
Kolfe	172	80	12,020
Lafto	244	154	48,800
Peacock	40	10	4,530
Akaki-Ad	2918	170	48,130
Akaki-Or	3354	3146	162,687
<b>Total</b>	<b>4108</b>	<b>3560</b>	<b>276,167</b>



## Adverse effect of climate change impact (flooding) on livelihoods of farm families in Akaki Oromiya vulnerable site

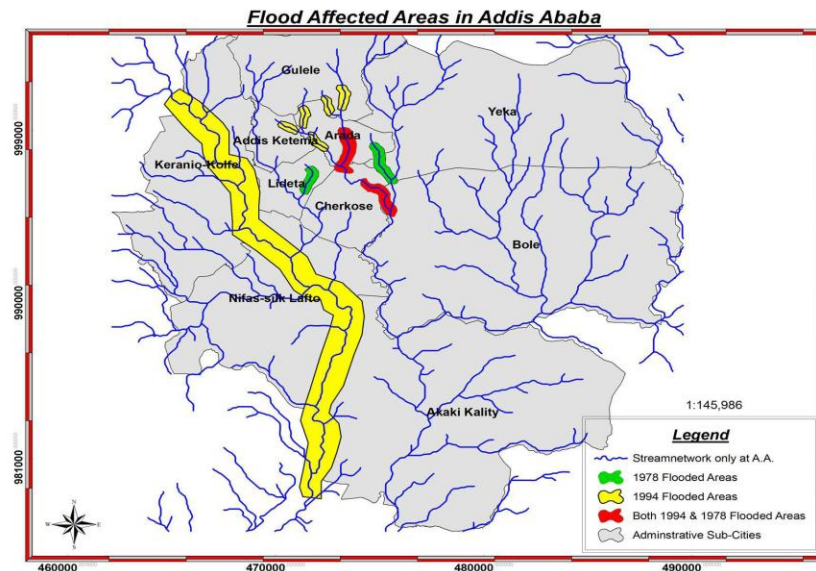
*“I have three children and all together we are five. My family lives from the income I get from this farm (farm irrigated with Akaki river). I used the income to cover my family’s food need, buy cloths, send my children to school and cover my health expense. Thanks to god, I spend about 700 Birr a month to cover all my family’s expense. I grow crop usually once per year since my farm usually get flooded with water as it is located near the river. Sometimes we grow two times a year when the rain is good and if the river is not overflow. If the river is get more water because of climate change, then we all loss our livelihood and I do not know what will happen to my family.*”

FGD participant at Akaki Oromiya site

## 7.2. Vulnerability of physical infrastructure of AA

- **Topography:**
  - ✓ City has rugged, steep topography with low permeability of bed rock;
  - ✓ Northern part is hilly and southern part is predominantly flat, making drainage density very high
- **Climate:**
  - ✓ High annual average rain fall
- **Water body & its rout**
  - ✓ Akaki rivers: little & Great Akaki rivers. Little Akaki river passes through densely populated
  - ✓ Many streams flowing across the city
- **Settlement & economic importance**
  - ✓ Many houses located near the river
  - ✓ Many depend on the river for livelihood
- **Vulnerability Implications:** riverine flood & street flooding

Damage	1978	1994
Number of people killed	12	3
#of houses damaged	1255	954
# of affected people	6000	7655
# of people became homeless	Many	2880
Cost of damage '000 Birr)	NA	15,400



# Physical vulnerability...

## a. Road and drainage

### ▪ Road

- ✓ The city has far from adequate road infrastructure (density & quality). 6.1% of total built-up areas in 2005.
- ✓ 2250 KMs, of which 850 KMs are asphalted.
- ✓ Easily trap & retain rainwater, muddy & slippery in wet season; and dusty in dry season.
- ✓ Side walks in asphalted roads are almost absent despite walking is predominantly mode of travel

### ▪ Drainage

- ✓ 29% of the city's road mileage are equipped with drainage, resulting in rising storm is being discharged in this limited drainage system.

### ▪ Vulnerability Implications:

- ✓ high level of street flooding, road will be easily exposed to damage and are more sensitive; people will be more exposed to street flooding and dusty, resulting in disruption of transport, higher health expense & low productivity & higher adaptation cost

# Physical vulnerability ...

## b. Water supply & sanitation

### ■ **Water supply:**

- ✓ Sources: surface water (76%) and Ground Water (24%)
- ✓ Water consumption: 25 - 45 l/c/d, very low by international standard.
- ✓ 88.5% of HHs in AA have access to potable water.
- ✓ There is high disparities among the different sub cities. Bole has the highest access to WS & Yeka, Ak-Kaliti & Nifas-Silk
- ✓ One-fifth of HH (mainly the poor) spend >10% of their monthly income for water.
- ✓ Water shortage & frequent interruption (2 – 3 days/week) is common problem in the city.

### ■ **Sanitation:**

- ✓ Very low coverage: pit latrine is the most common form of toilet (75%). Most dispose to nearby stream/river and increase pollution.

# Physical vulnerability ...

## c. Wastewater management

- ✓ **Composition:** domestic ww (70%) and industrial & other (30%).
- ✓ **Management:** Almost all disposed untreated to Akaki river
  
- **WSS & WW: Implications to vulnerability:**
  - ✓ cc exacerbate the vulnerability of those currently have no access to improved services,
  - ✓ women are more vulnerable as water fetching is their job, (increase their burden)
  - ✓ the whole city's residences are vulnerable to shortage of water, particularly during dry season.
  - ✓ Downstream community, who use Akaki river for domestic purposes, are more vulnerable
  - ✓ Vegetable growers will be more affected

# Lack of Access to WSS & ww and its effect

## Akaki-Oromiya site

*“I and my family have been drinking the water from Akaki river, using it for washing cloths, taking shower and send cattle to drink it for the last 40 years. My villagers do the same since we do not have other alternative sources. Though I am still alive, I and my children have been sick frequently with diarrhea and skin irritation. If things are not improved, the future may be more problematic”*

An old woman participated in FGD at Akaki-Oromiya site

**Thank you**