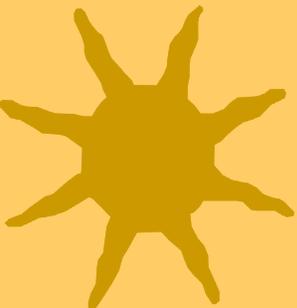
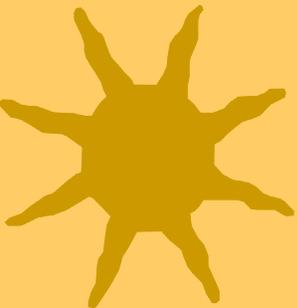
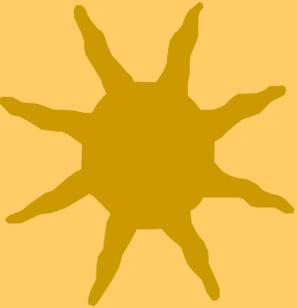


Welcome





ADAPTATION TO CLIMATE CHANGE FOR SUSTAINABLE DEVELOPMENT OF BANGLADESH AGRICULTURE

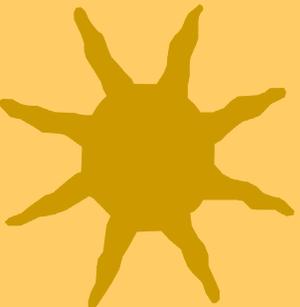
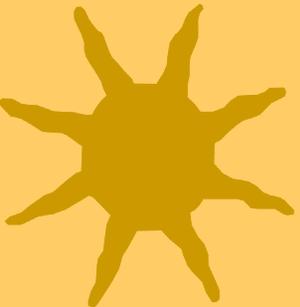
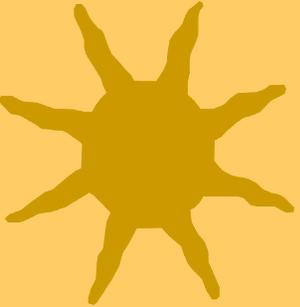


Bangladesh Country Paper

**M.Harun-ur-Rashid
And
M.Shirazul Islam**



Global climate change

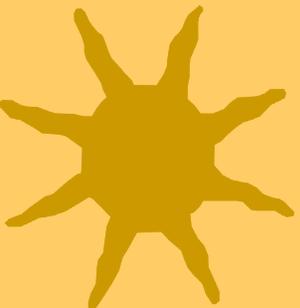
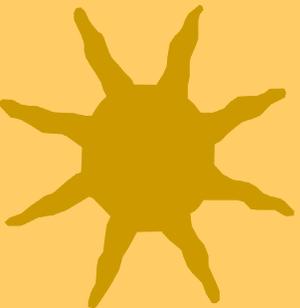
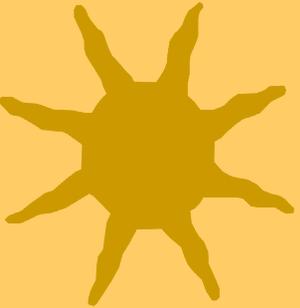


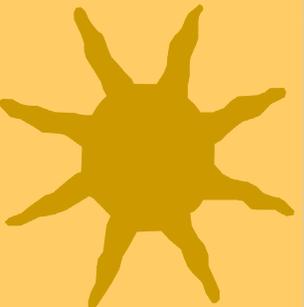
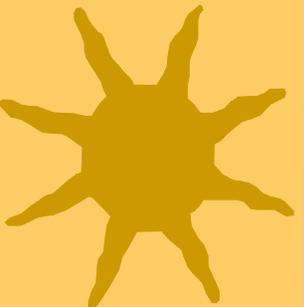
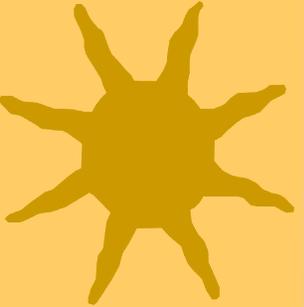
- **Global warming has caused fundamental changes to our climate**
- **Climate related extreme events like heavy rainfall, flood, cyclone, storm surges etc.have increased**
- **Eco-system has changed and suffering of people has increased**
- **Ice melting has increased**
- **Claimed thousands of lives, destroyed billions of dollar worth properties, disrupted livelihood of hundreds of millions**
- **And much more are expected**



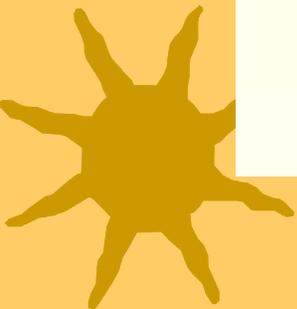
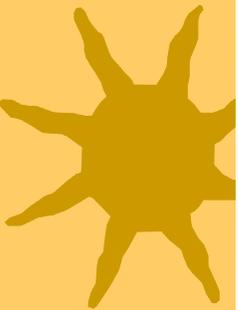
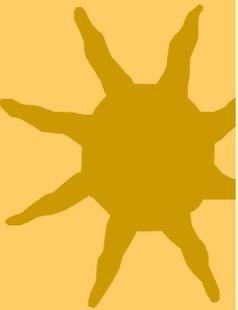
World Watch Institute report

‘World Watch Institute’ an international research organization, has published a report on 22 October realizing that due to rise of sea water level for climate change, 21 countries of the world including Bangladesh are under serious risk. The report adds, due to climate change, small and large disasters have become frequent.



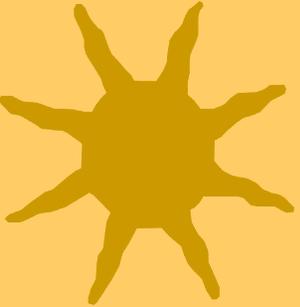


Climate Change in Bangladesh





About Bangladesh



Area of Bangladesh : 147,570 sq. kilometer

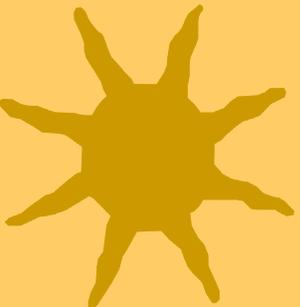
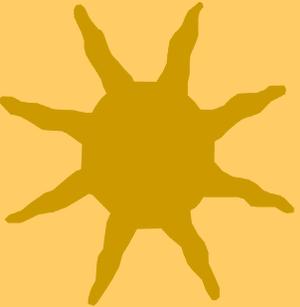
Population : 140 million

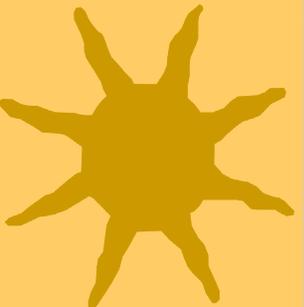
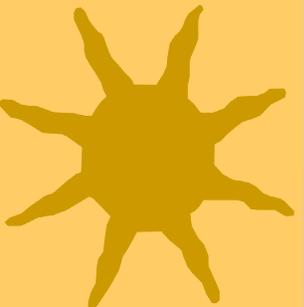
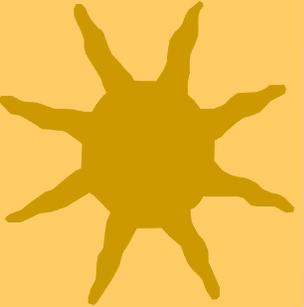
Agricultural land : 9.03 million ha.

Hill area : 12.5% of total area

Coastal area : 2.50 million ha.

Saline area : 0.83 million ha.





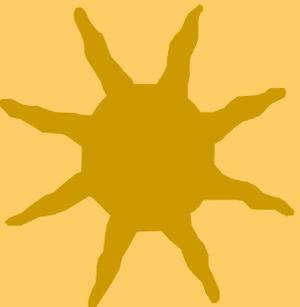
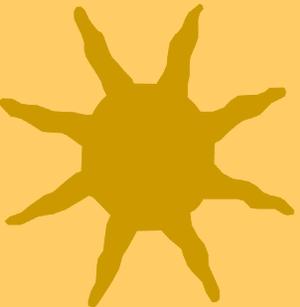
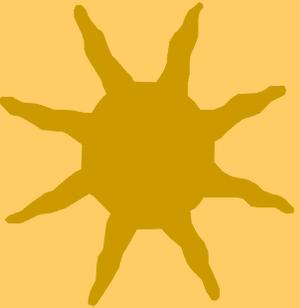
Bangladesh and climate change

- **Sudden, severe and catastrophic floods have intensified**
- **Bangladesh has been ravaged by floods of catastrophic Proportion in 1998, 2004 and 2007**
- **Heavy downpour over short spell has resulted in landslide**
- **Bad weather keeps the coastal waters risky of fishing expeditions**
- **Salt water from the Bay of Bengal has penetrated 100 km or more inland along the tributary channels during dry season**
- **The most affected sector is the Agriculture due to climate change**



Observed climate changes

- Annual average temperature has registered as increasing trend of about 1°C in May and 0.5°C in November from 1985 to 1998
- Annual mean rainfall exhibits increasing trends. Decadal rain anomalies are above long term averages since 1960s.



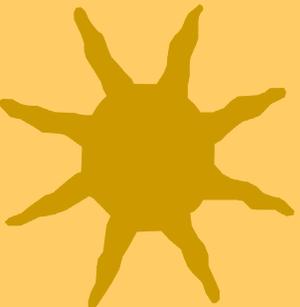
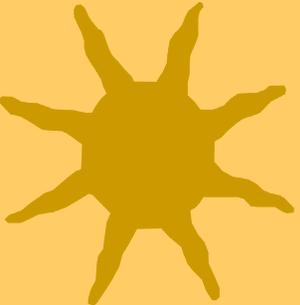
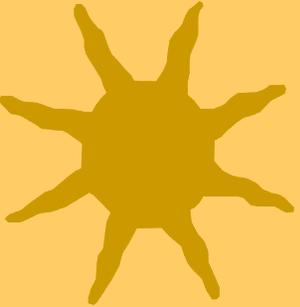


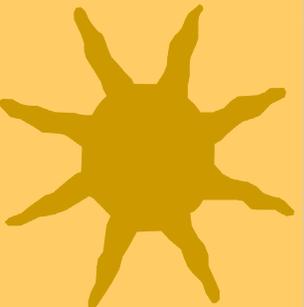
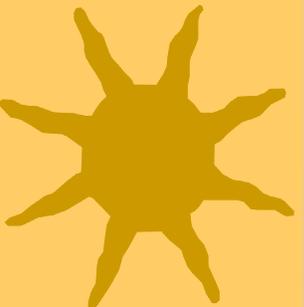
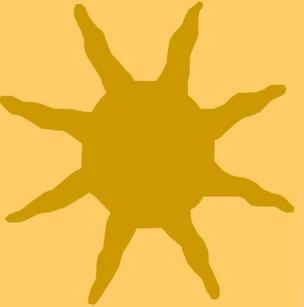
Bangladesh

- innocent victims of global warming

At 145 kilograms annually, Bangladesh has one of the lowest per capita emissions in the world. Yet a majority of its people, economy and ecological space has already been suffering due to global warming for which developed countries are primarily responsible. For Bangladesh, global warming induced climate change over this century-

- 1. threatening development**
- 2. challenging poverty reduction**
- 3. questioning human security**



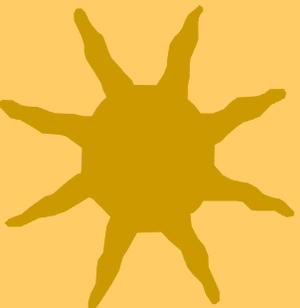
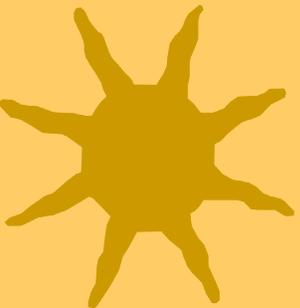
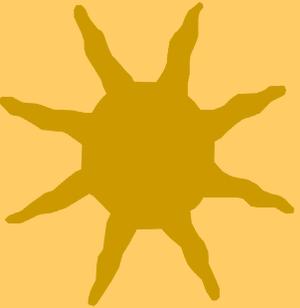


Impact of Climate Change



Impacts of climate change

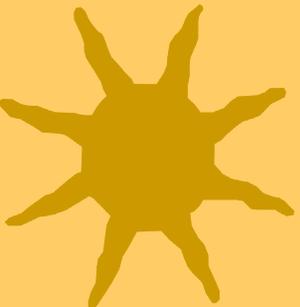
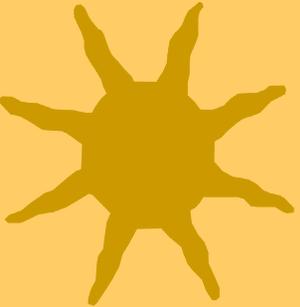
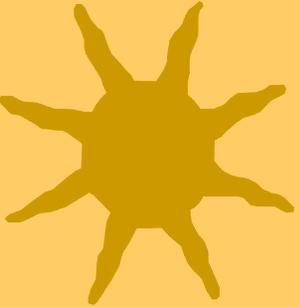
In Bangladesh, already there has been the impact of climate change on soil salinity, drought intensity and extent, crops and cropping patterns, irrigation water availability, irrigation cost etc. It is believed that these sectors will be further affected by the climate change





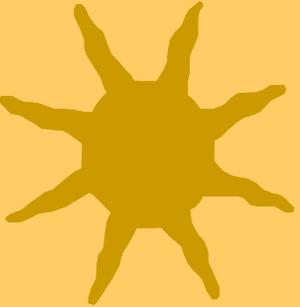
Impact on soil salinity

- In Bangladesh, soil salinity is observed only along the coastal belt
- Tidal flooding, inundation by saline and brackish water, saline groundwater movement in dry season cause salinity in soil
- In 1973, 1.5 million ha of land was under mild salinity
- In 1997, this expanded to 2.5 million ha
- FAO reports, the saline area may be more than 3 million ha at present
- Sea water rise will cause more land area under salinity

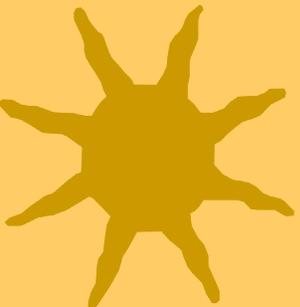




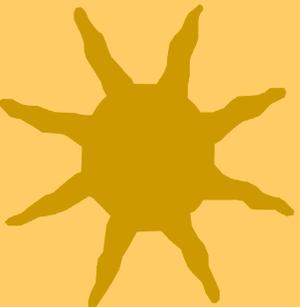
Impact on drought



Drought is a common natural disaster to the farmers of Bangladesh. It affects the country's agriculture greatly.



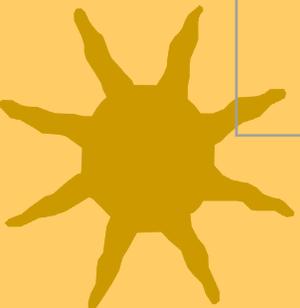
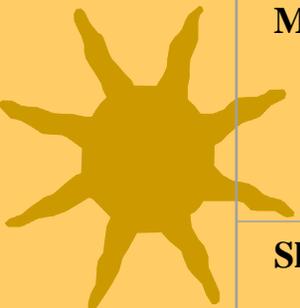
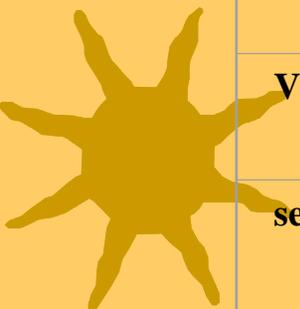
- 1. Every year, 3-4 million ha of land are affected by drought**
- 2. Among 8.3 million ha of cultivable land, about 5 million ha are used for Aman rice cultivation and it is grown rain-fed**
- 3. A survey by Bangladesh Agricultural Research council shows that 4.2 million ha are prone to drought of different intensities**
- 4. With further climate change, the drought prone area is expected to increase rapidly**





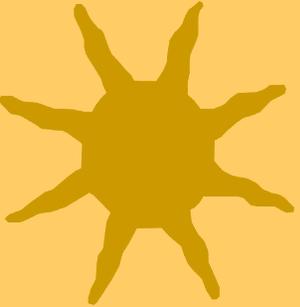
Intensity of drought and yield loss of T.Aman

Intensity of drought	Area of Land,ha	Location	Average yield, t/ha)	Yield loss due to drought, %
Very severe	342990	Rajshahi, Nawabgonj	1.7-2.5	70-90
severe	737028	Barind area, Gangetic alluvium	2.0-2.5	50-70
Moderate	3154950	Western, central and southern regions, Modhupur tracts, kushtia and Jessore	2.5-3.5	30-50
Slight	2867895	Teesta Brahmaputra and Gangetic Alluvium, Alluvium soils of Meghna and Surma-Kushiara rivers	3.0-4.0	10-30

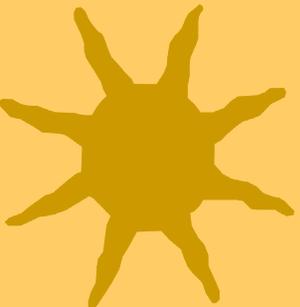
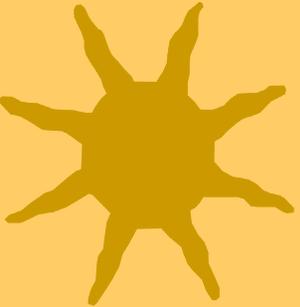




Impact on crop and cropping pattern



- 1. Due to temperature and humidity changes, some crop will be eliminated or produce less yield**
- 2. Insect infestation and pest and disease infections will be increased**
- 3. The whole cropping patterns of the country may be changed**



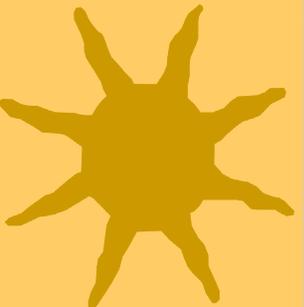
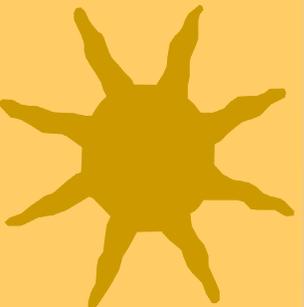
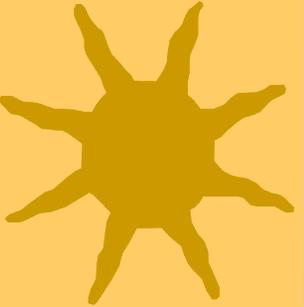


Irrigation equipment status

Irrigation equipment	Number in operation	Irrigated area mha	% irrigated area
DTW	27117	0.65	13.57
STW	1128991	3.16	65.97
LLP	99255	0.84	17.54
Traditional method like don, swing basket etc.	-	0.03	0.62
Gravity flow method	-	0.11	2.30



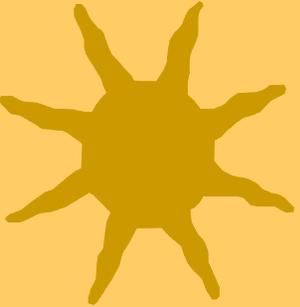
Impact on irrigation



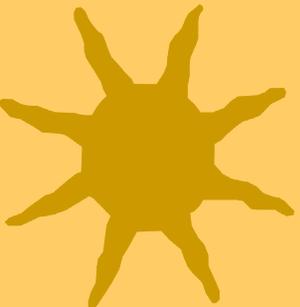
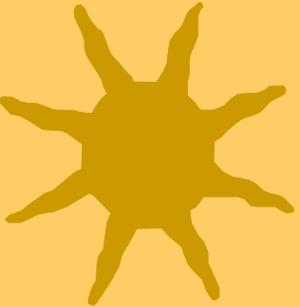
- 1. loss of ET will be higher with higher temperature**
- 2. yield of some crops will be decreased due to higher temperature and shortened winter; i.e wheat**
- 3. surface waters will dry out restricting LLP irrigation**
- 4. Groundwater table shows a natural annual fluctuation of about 3.6 m but failed to return to its previous years level**



Impact on irrigation (continued)

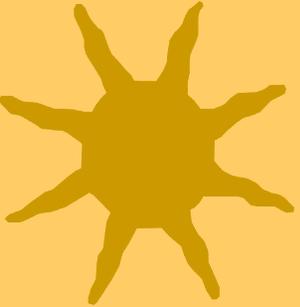


5. more area will face groundwater problems due to increased groundwater use (Barind, Dhaka, Joydebpur and Commilla)
6. Groundwater levels will have higher declination leaving a large number of suction mode pumps go dry
7. irrigation cost will go high due to higher energy cost

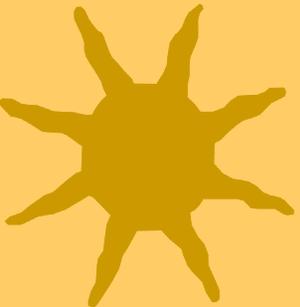




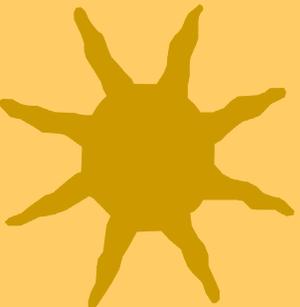
Impact on traditional agricultural practices



1. Traditional agricultural practices will be affected by temperature rise, prolonged drought and heavy shower



2. High temperature or drought will lead to rapid dry up of soil moisture leaving minimum time for land preparation for the next crop after Aman rice

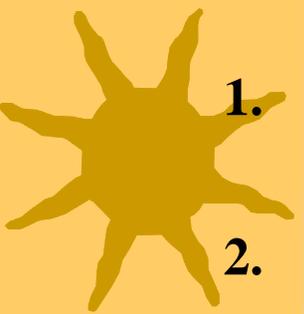


3. Traditional plow will find it difficult to complete the operation in a short time

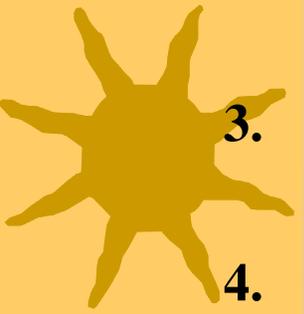
4. Seeding, weeding, harvesting, threshing, winnowing and intercultural operations by traditional method will be found inappropriate



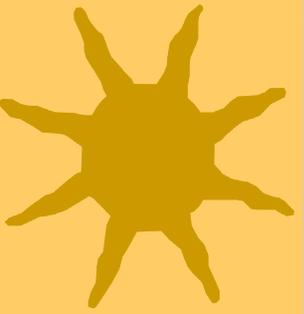
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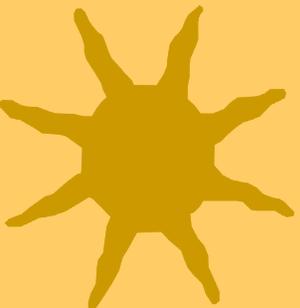
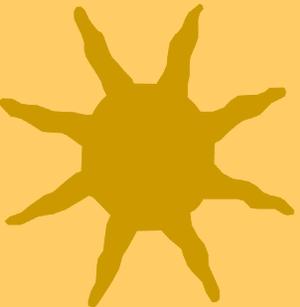
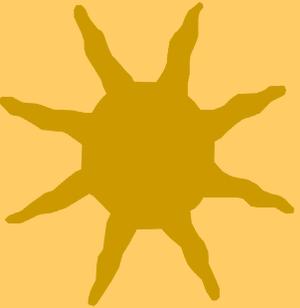
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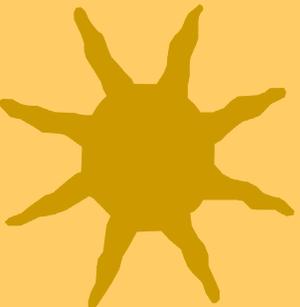
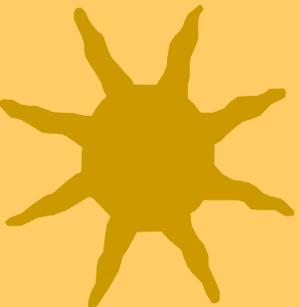
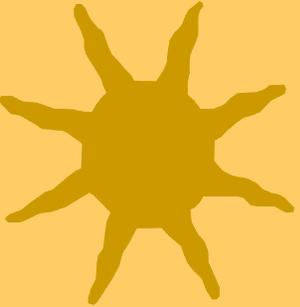
Impact on cyclones and tornadoes

- 1. Frequency and intensity of cyclones and tornadoes will be higher due to climate change**
- 2. Cyclones accompanied by tornadoes will be more fatal**
- 3. Death or injury, disease outbreak, damaging houses, food shortage, loss of livestock and crops, destruction of infrastructure will be higher**





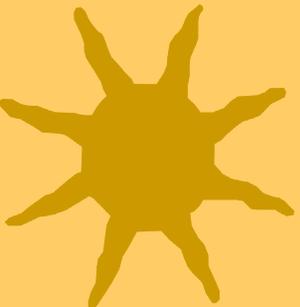
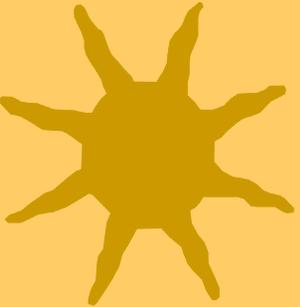
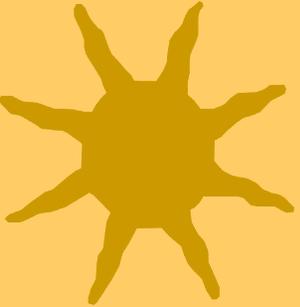
Impact on floods



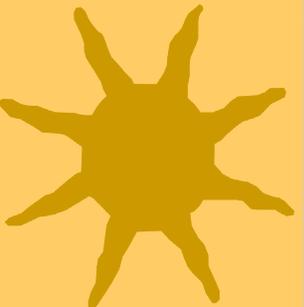
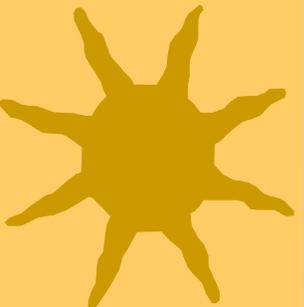
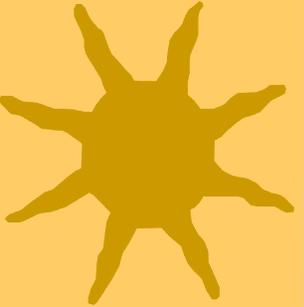
- 1. Flash floods will be intensified due to climate change**
- 2. In 2002, flash floods destroyed 80,000 acres land in Chittagong and Cox's Bazar districts**
- 3. River floods will be much stronger due to higher snow melts and will cause greater loss of life and property**
- 4. In 2007, floods of higher magnitude attacked Bangladesh twice destroying lives and properties**
- 5. These caused death or injury, disease outbreak, damage to houses, loss of livestock and crops, destruction of infrastructure etc.**



Impact on shrimp culture



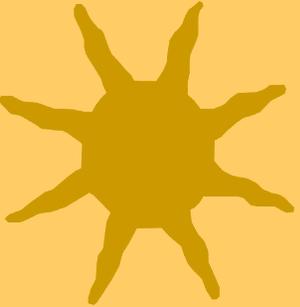
- 1. Due to intrusion of soil salinity, more non-saline area will go under salinity inviting more farmers to shrimp culture**
- 2. This practice is moving towards inland destroying non-saline crop lands**
- 3. The repeated practice will gradually increase salinity of the soil**



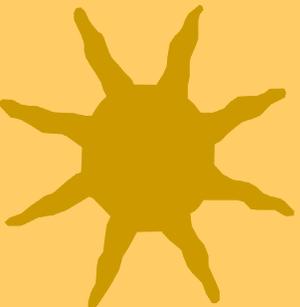
Adaptation to Climate Change



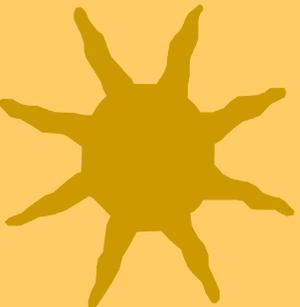
Strategic adaptations to climate change



1. Climate change offers an additional challenge for policy makers and planners in Bangladesh



2. Key adaptations in agriculture would aim at changing agricultural practices to improving water use efficiency and crop diversification

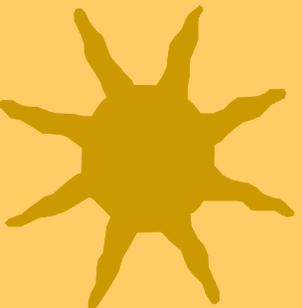
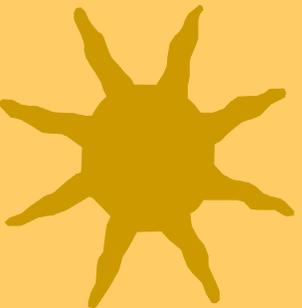
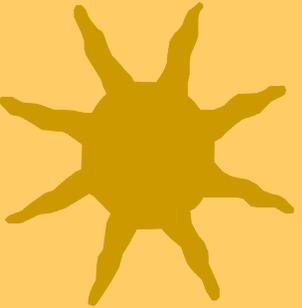


3. Development and introduction of new varieties and corresponding dissemination measures are important and need to be facilitated by international research

4. Experience with new crops and agricultural practices, if built up and shared on the farm level, this sector may not be as flexible to climate change as is widely believed



Change in crop production strategy

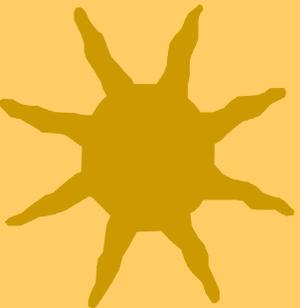
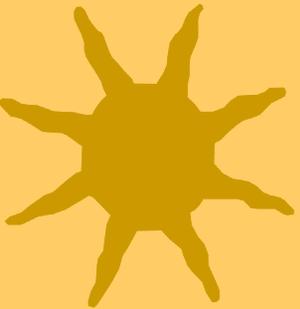
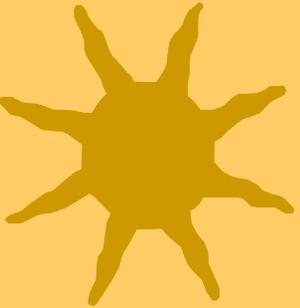


1. Based on nature of soil, location and climate, crop varieties and cultivation method are to be selected
2. At present, there is no crop variety that can withstand salinity in the range of 6-12 dS/m. So new crop varieties to be developed that can withstand higher salinity
3. Improved managements such as crop cultivation on raised beds with mulches and drip irrigation have been found very suitable for growing horticultural crops like tomato, chili, watermelon and cucumber
4. The method could reduce soil salinity from 10 - 11dS/m to 4.5 - 5.5 dS/m
3. Instead of shrimp culture alone, Boro rice and shrimp (lobster) cultivation to be introduced



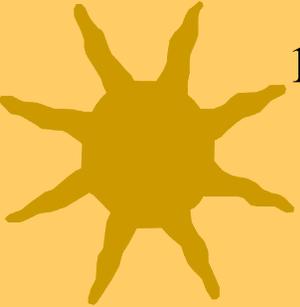
Mitigation measures for cyclones and tidal surges

1. Efforts being continued to construct shelter and cross dams along the coastal belts
2. In addition, forestation, forecasting, increasing consciousness of the people and building communication systems are some of the on going activities to mitigate effects of cyclones





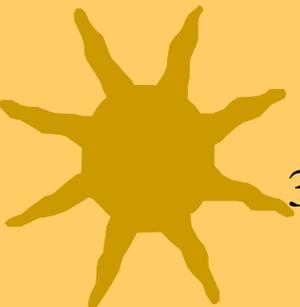
Farming system development by agricultural machines



1. After Aman rice harvest, in many places of the country the soil becomes dried rapidly making the soil so hard to work with traditional ploughs. Improved plow machines can be used with tractor for land preparation



2. After Aman harvest, there is left only a small period of time to prepare land for the next crop. Use of modern machines can help timely completion of operation



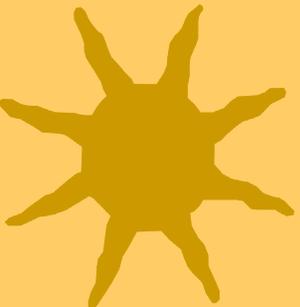
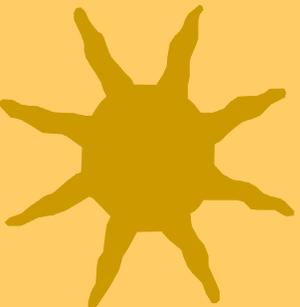
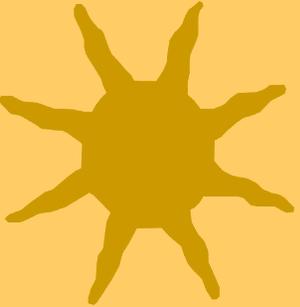
3. However, many are advocating no tillage or zero tillage practices after Aman harvest to conserve moisture and save time
3. Reapers can be used for quick harvesting and make the land prepared for the next crop in time



Role of agricultural engineers

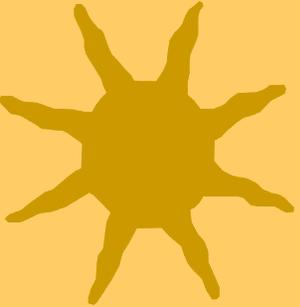
In Bangladesh, agricultural engineers are working in various Institutes or organizations such as research institutes, Agricultural Development Corporation, Barind Multipurpose Development Authority, Department of Agricultural Extension and many other Government and non-government organizations. They can help the farmers and farming systems in many ways:

1. In developing proper irrigation scheduling and constructing better conveyance and distribution systems they can cooperate with the end users for better crop production
2. Selecting appropriate irrigation machines like engines, motors and pumps in respect of power consumption, durability and efficiency they can also help improve performance of the machines.

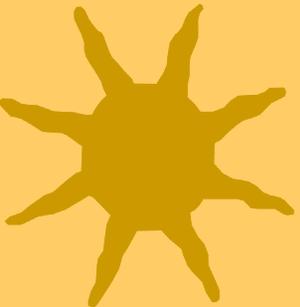




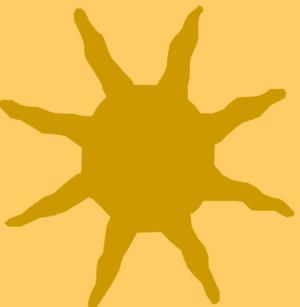
Role of agricultural engineers (continued)



3. They can also help the farmers of moderate saline areas to grow horticultural crops by demonstrations on how to manage soil salinity using raised beds, mulches and drip irrigation



4. Engineers associated with farm machinery development can devise better machines and disseminate the improved technologies among the farmers

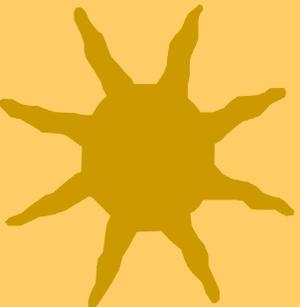
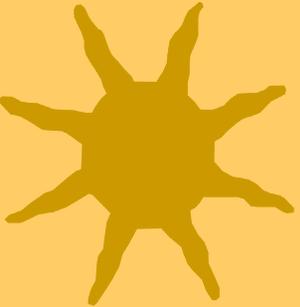
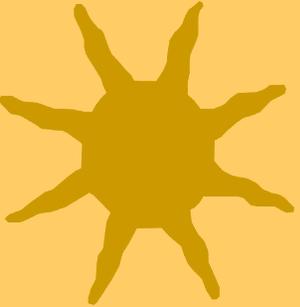


5. They can participate in national agricultural policy making forums and suggest better themes



National response

- Undertaken climate change country studies
- Active participation in global negotiation process
- Submission of national communication
- Preparation of National Adaptation Program of Action (NAPA)
- Establishment of designated national authority
- Establishment of climate change cell in the development of environment
- Formation of national committee to guide preparation of national policy and action plan and to develop strategies for implementation of NAPA

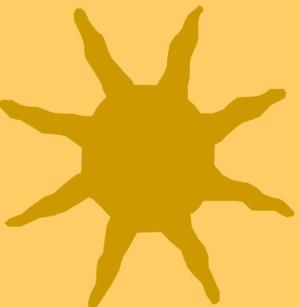
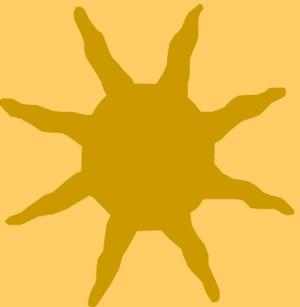
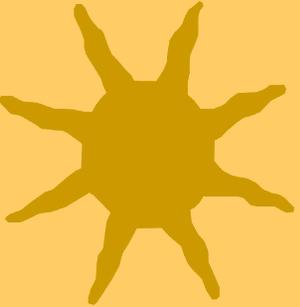




Need for climate change

Policy and action plan

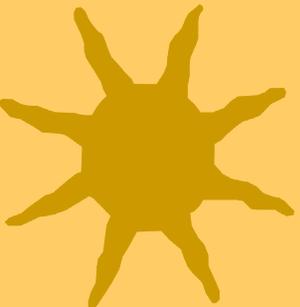
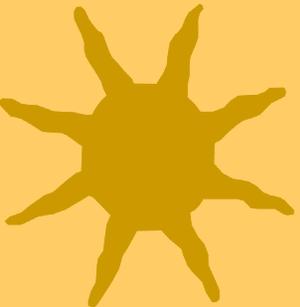
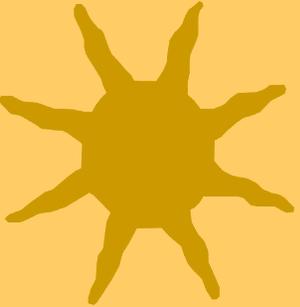
1. To harness, guide, coordinate all the national and international response and process to interpret climate risk into development plans and processes
2. Identification of prevailing, emerging and long term issues, concerns, potentials, response options
3. Providing frameworks for climate resilient development
4. Providing strategy and implementation plan

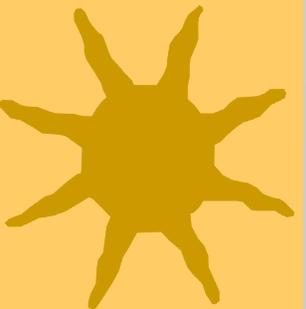
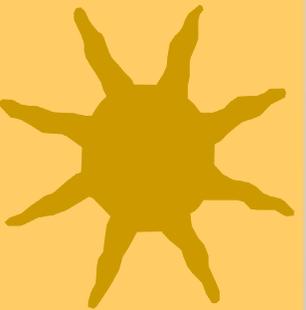
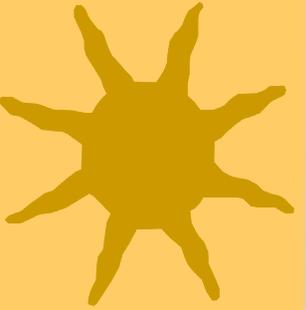


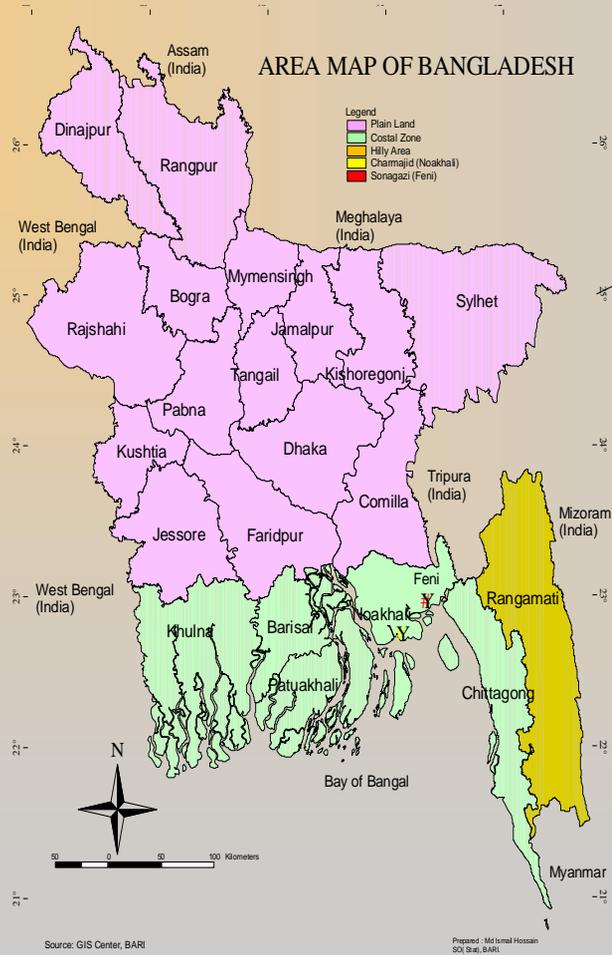
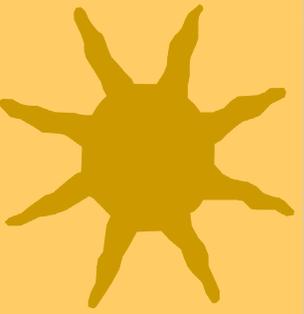
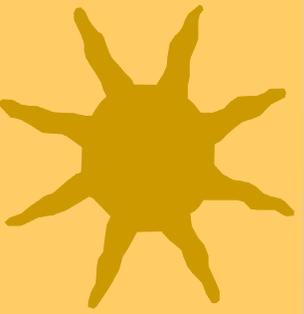
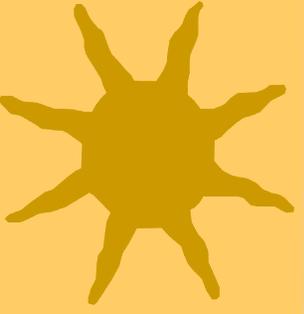


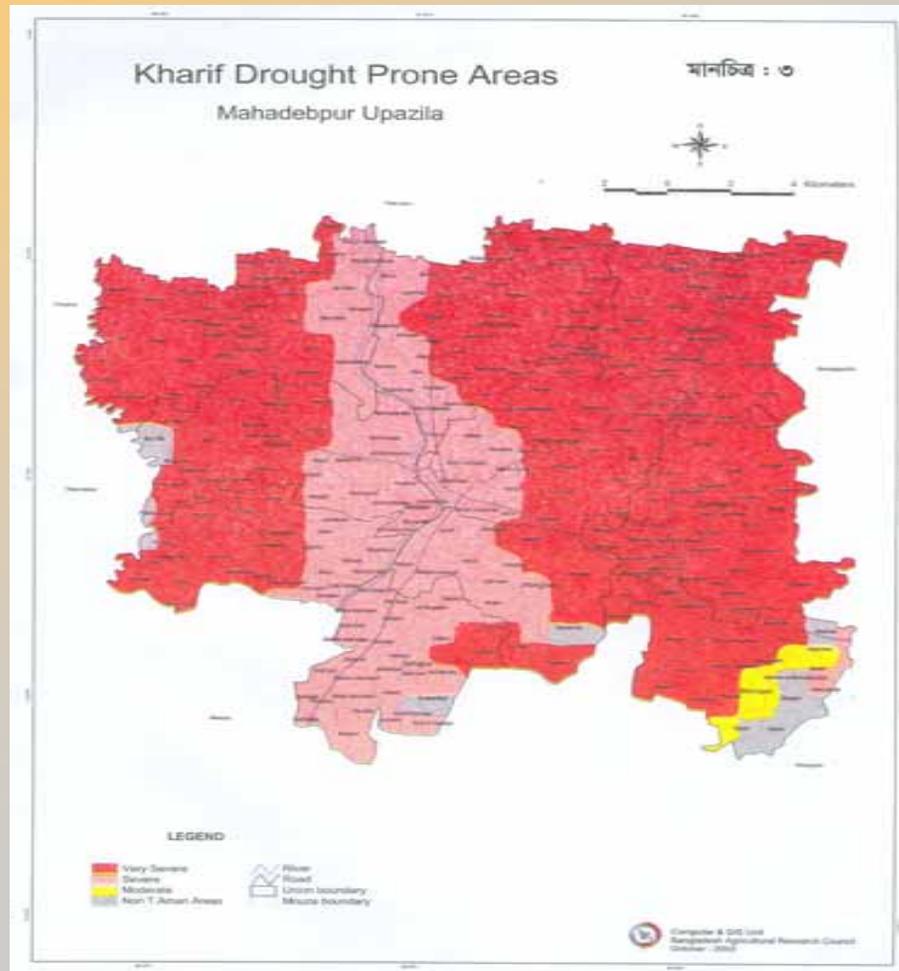
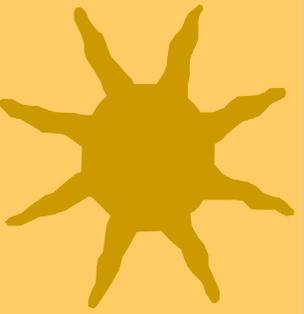
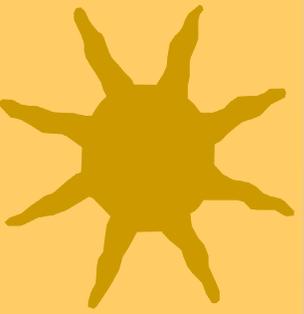
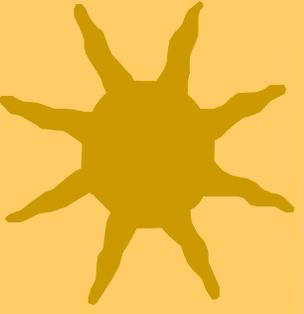
Conclusions

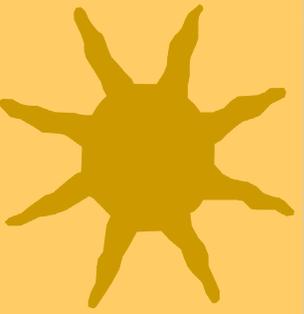
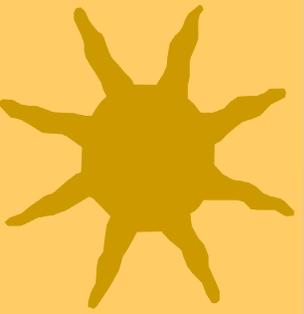
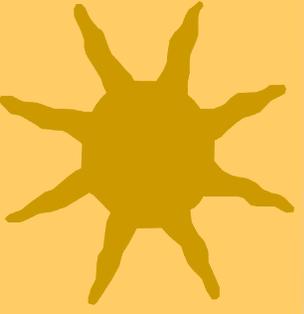
Climate change is not only an environmental concern but also a development concern for Bangladesh. This means that climate change as an issue must come out of the environmental problems to take center stage as a major development problem. The promising anticipatory adaptations are changes in behavioral patterns, human practices and international actions. Agricultural engineers should also look into these changes and design their action plan for the mitigation of the disasters from climate change. Also they should proceed with integrated approach.

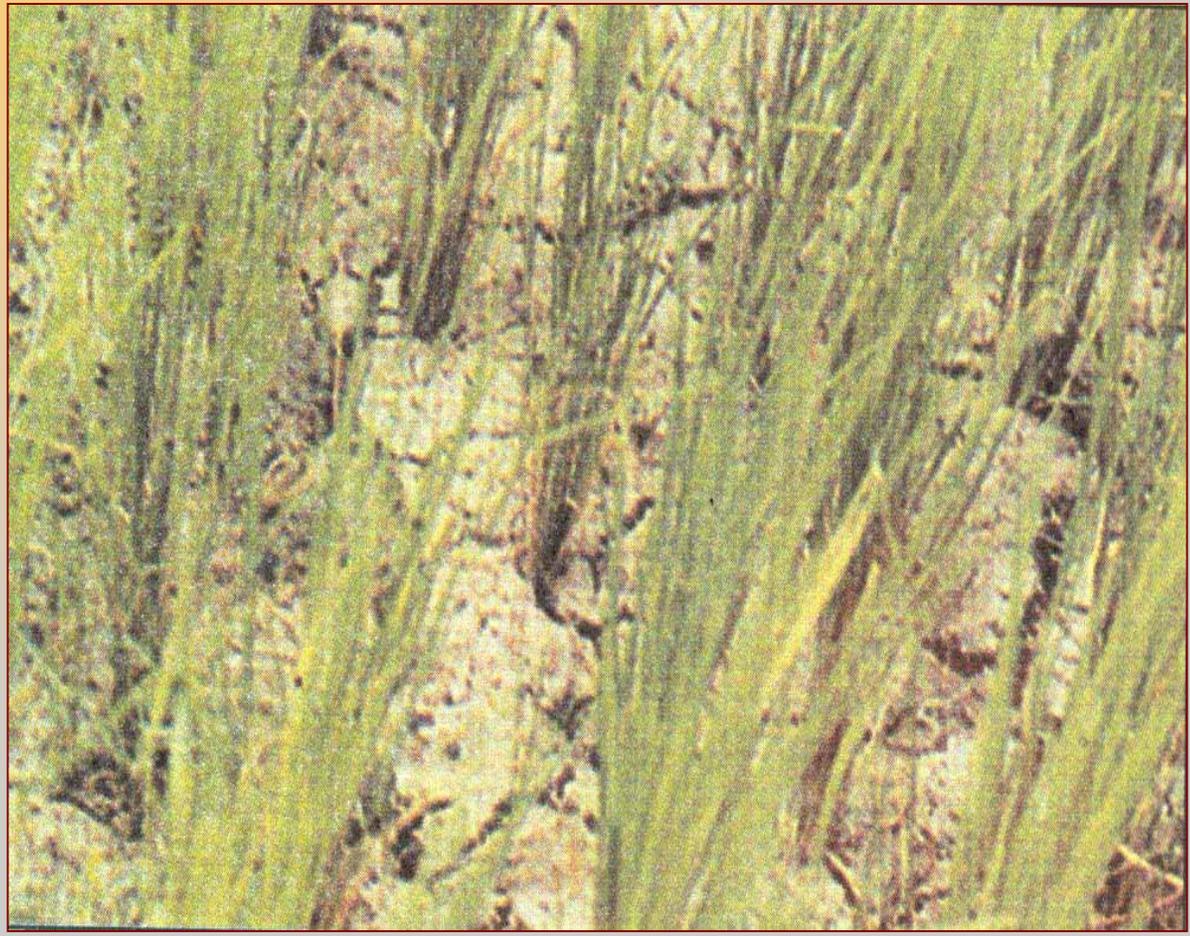
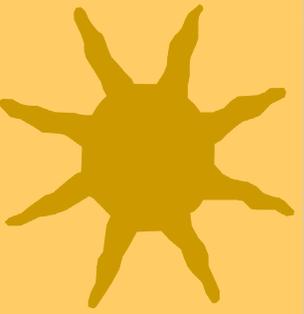
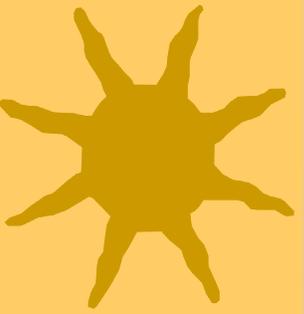
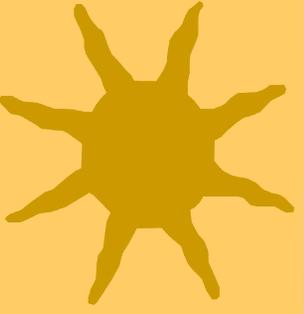


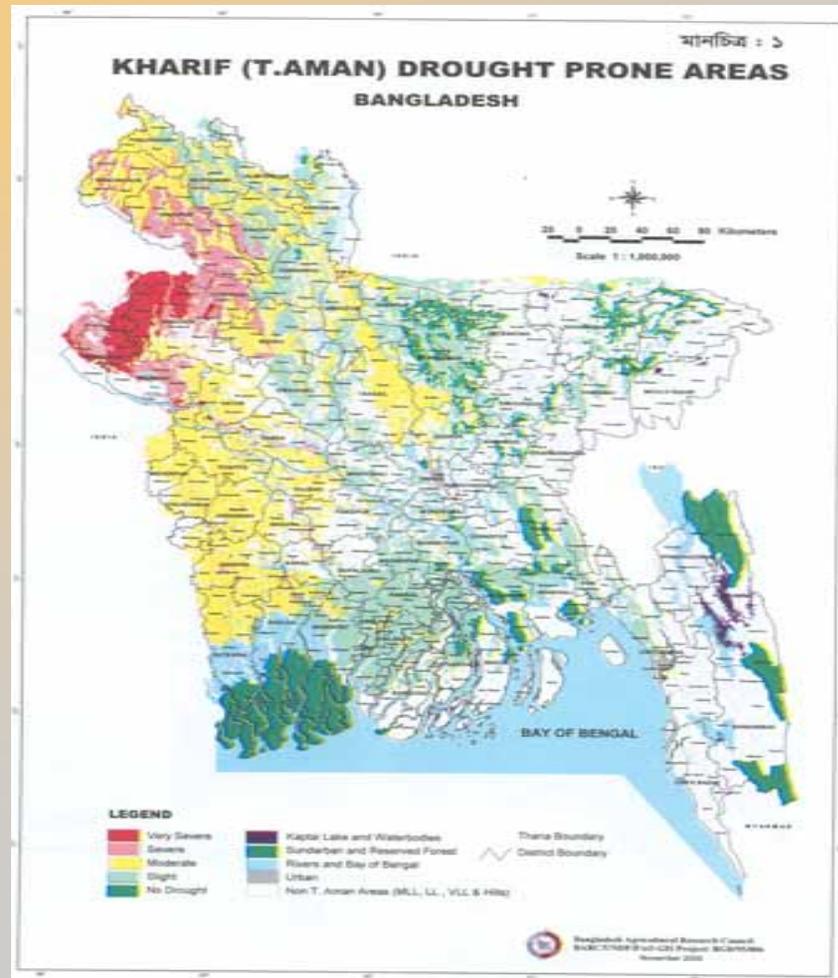
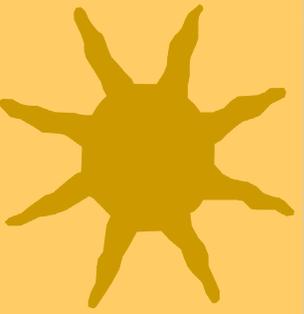
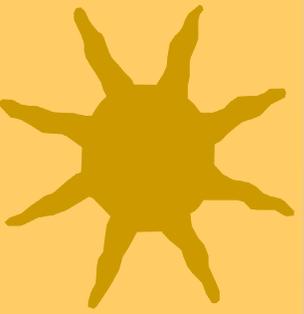
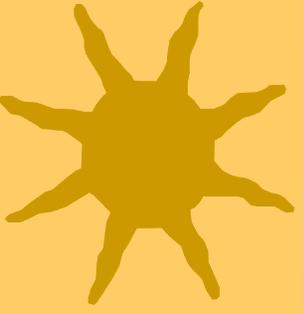


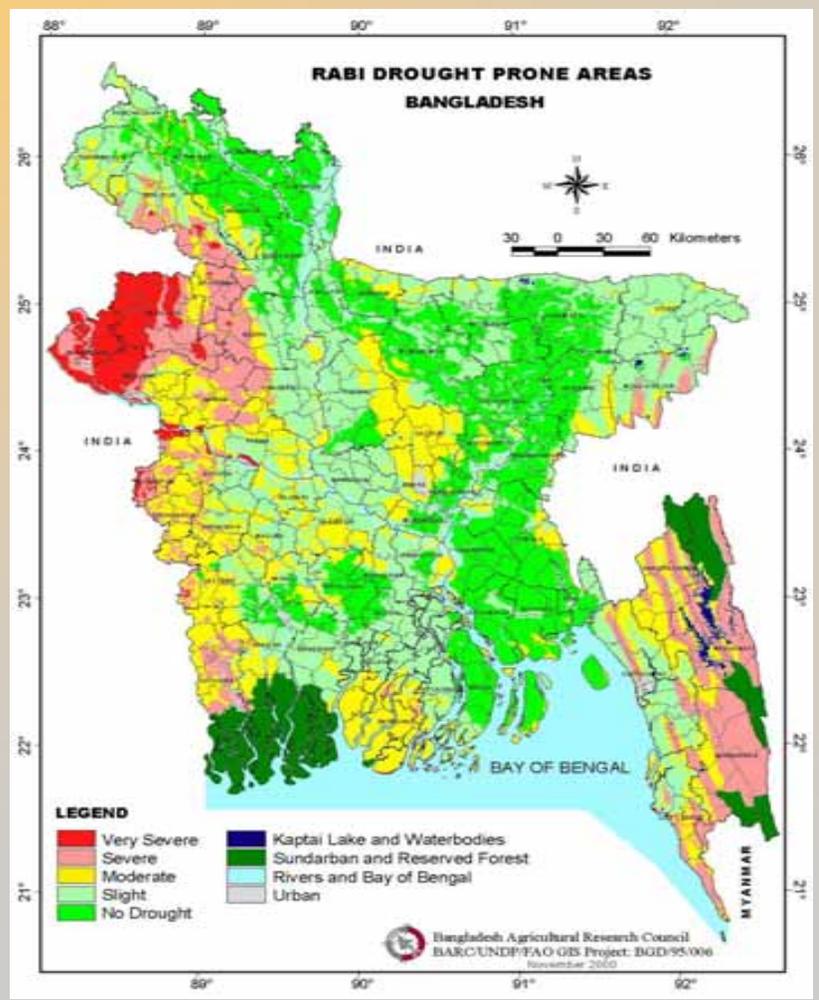
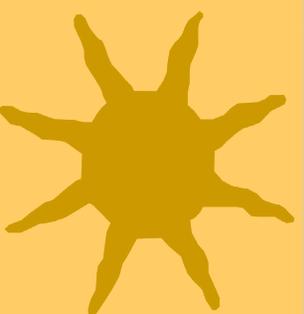
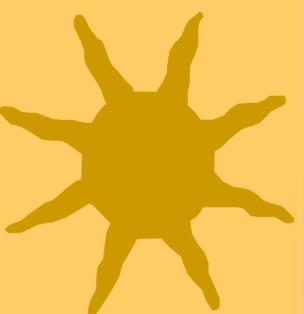
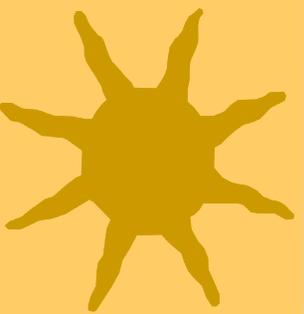


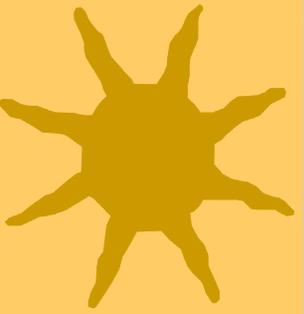
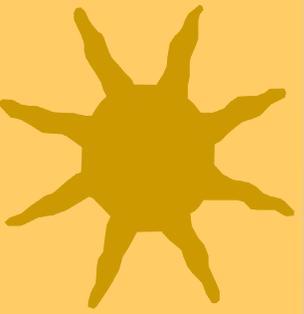
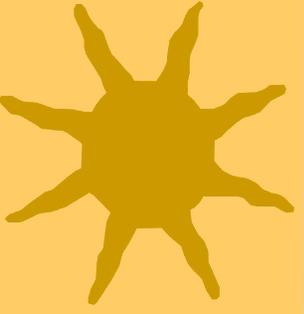


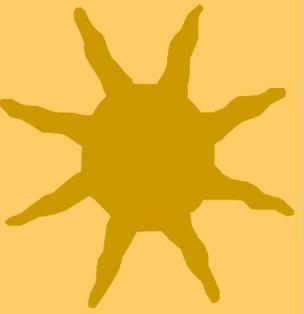
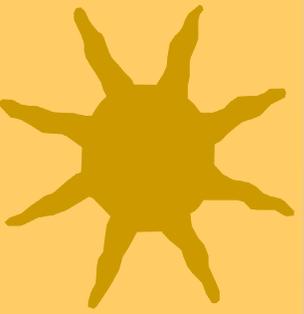
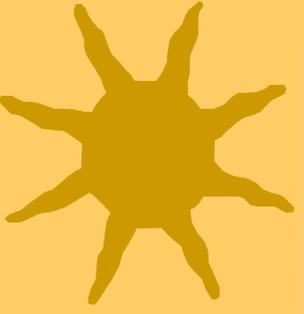


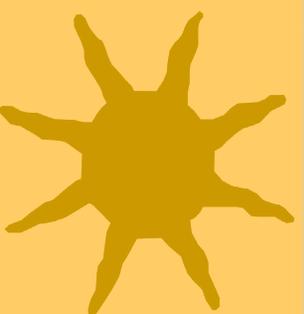
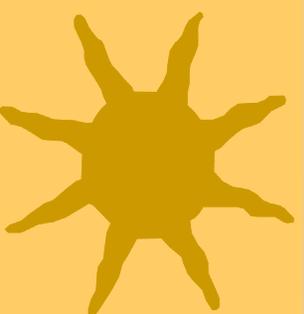
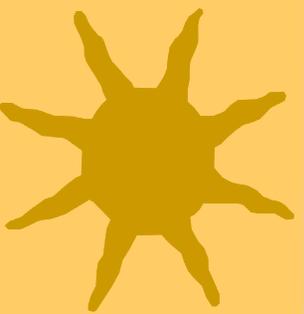


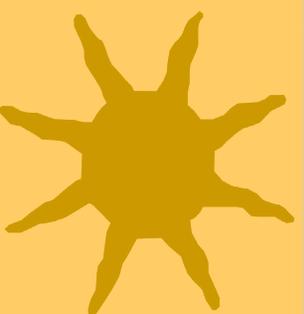
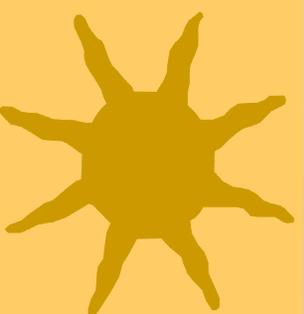
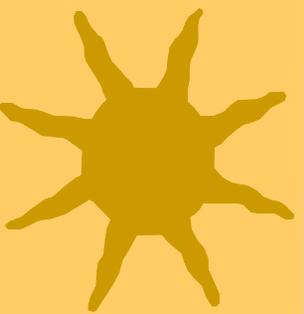




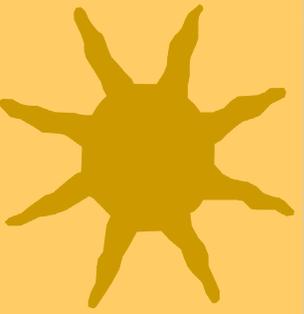
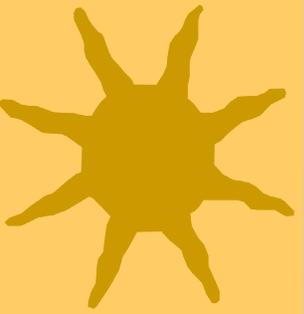
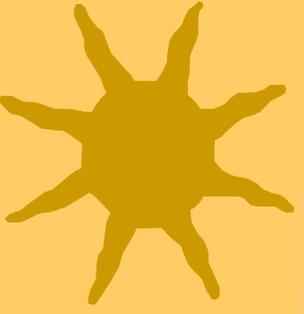








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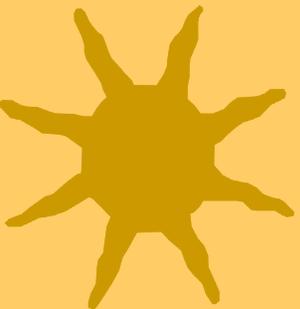
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Tomato in raised bed with mulch



Vegetative stage of tomato





Thank You