Agricultural Engineering Technologies for Climate Change Mitigation and Adaptation and for Sustainable Agriculture in the Philippines

by

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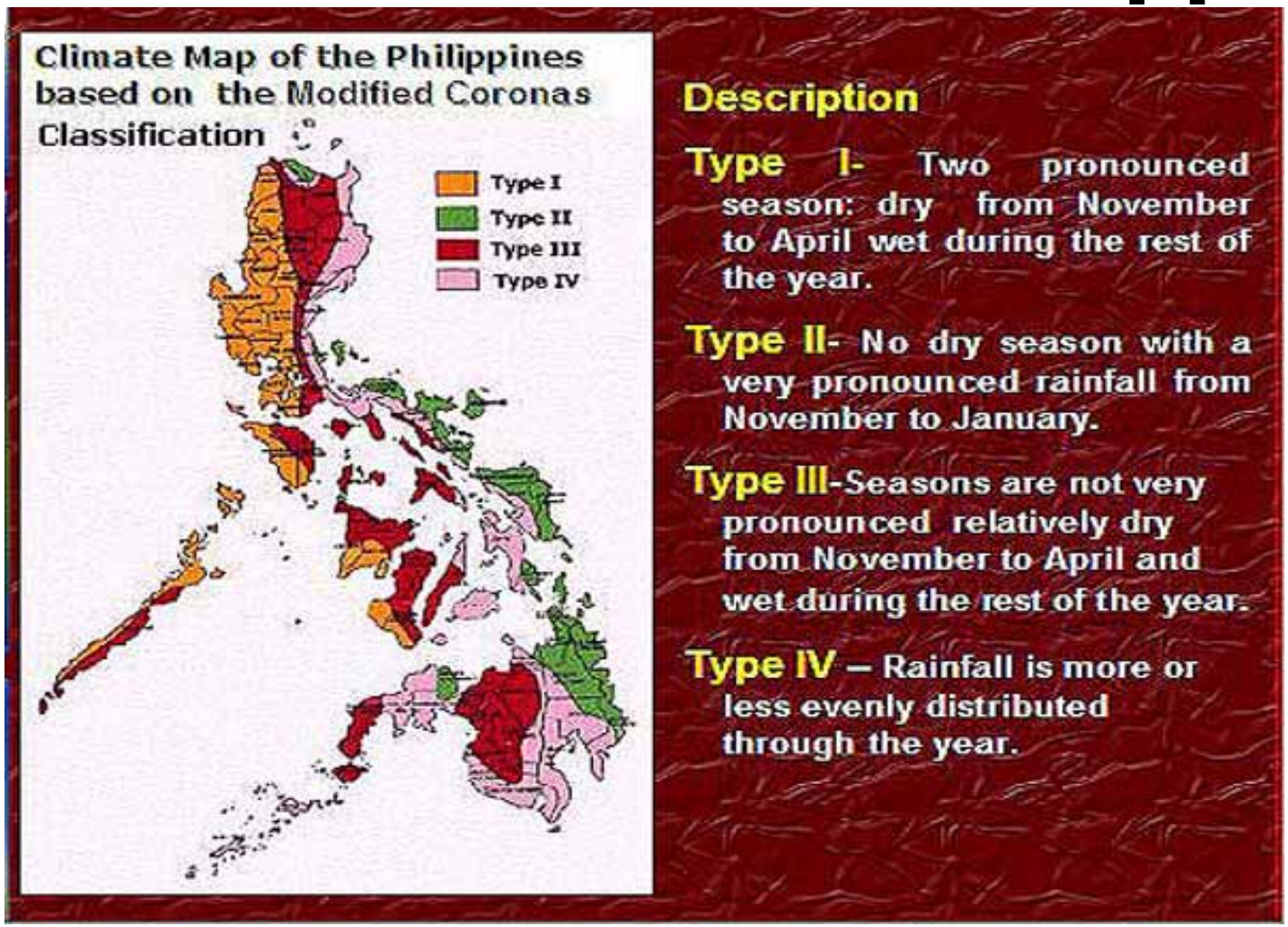
Background Information

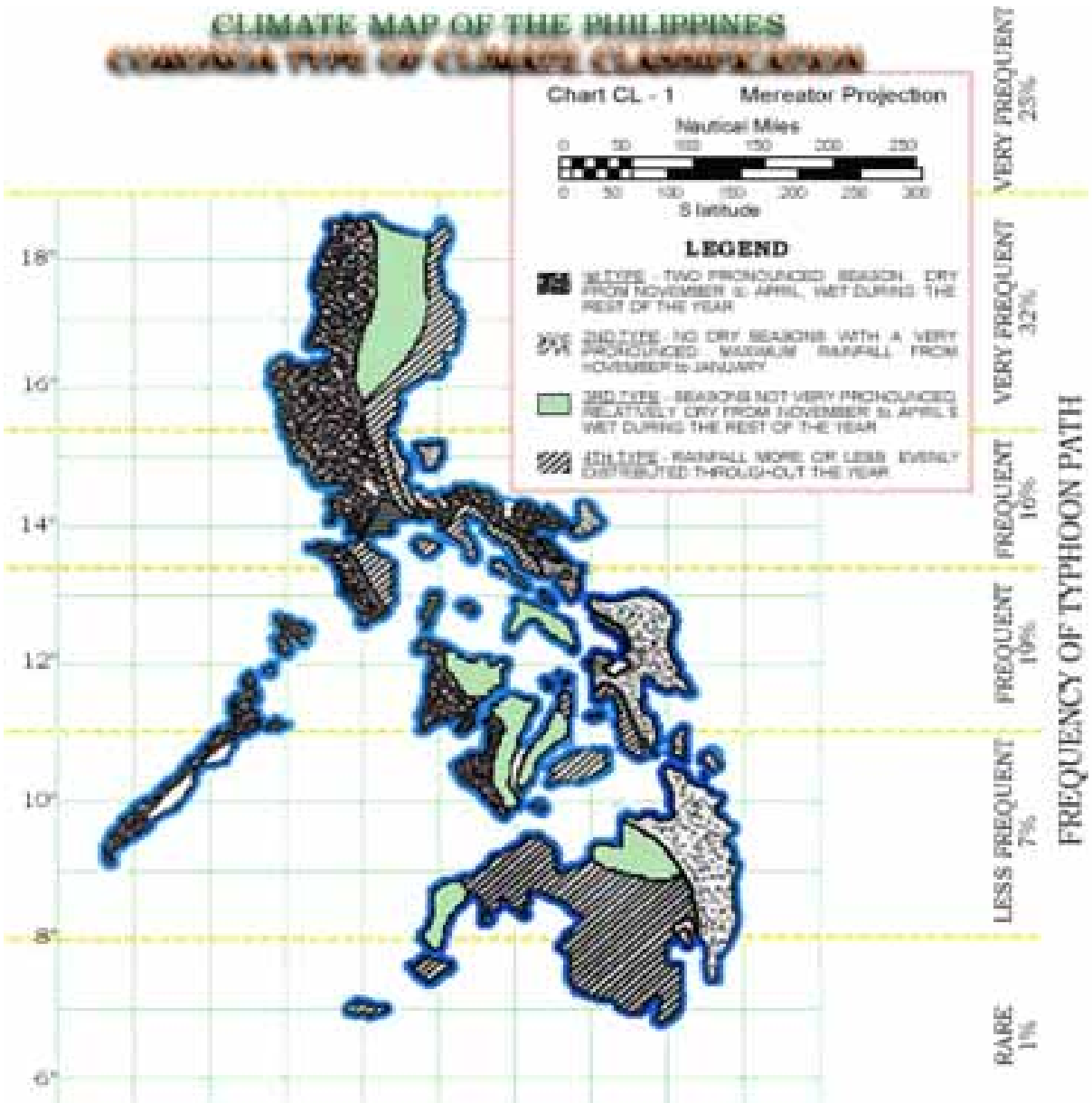
General Climate in the Philippines

General Climate in the Philippines



Source: PAGASA

General Climate in the Philippines



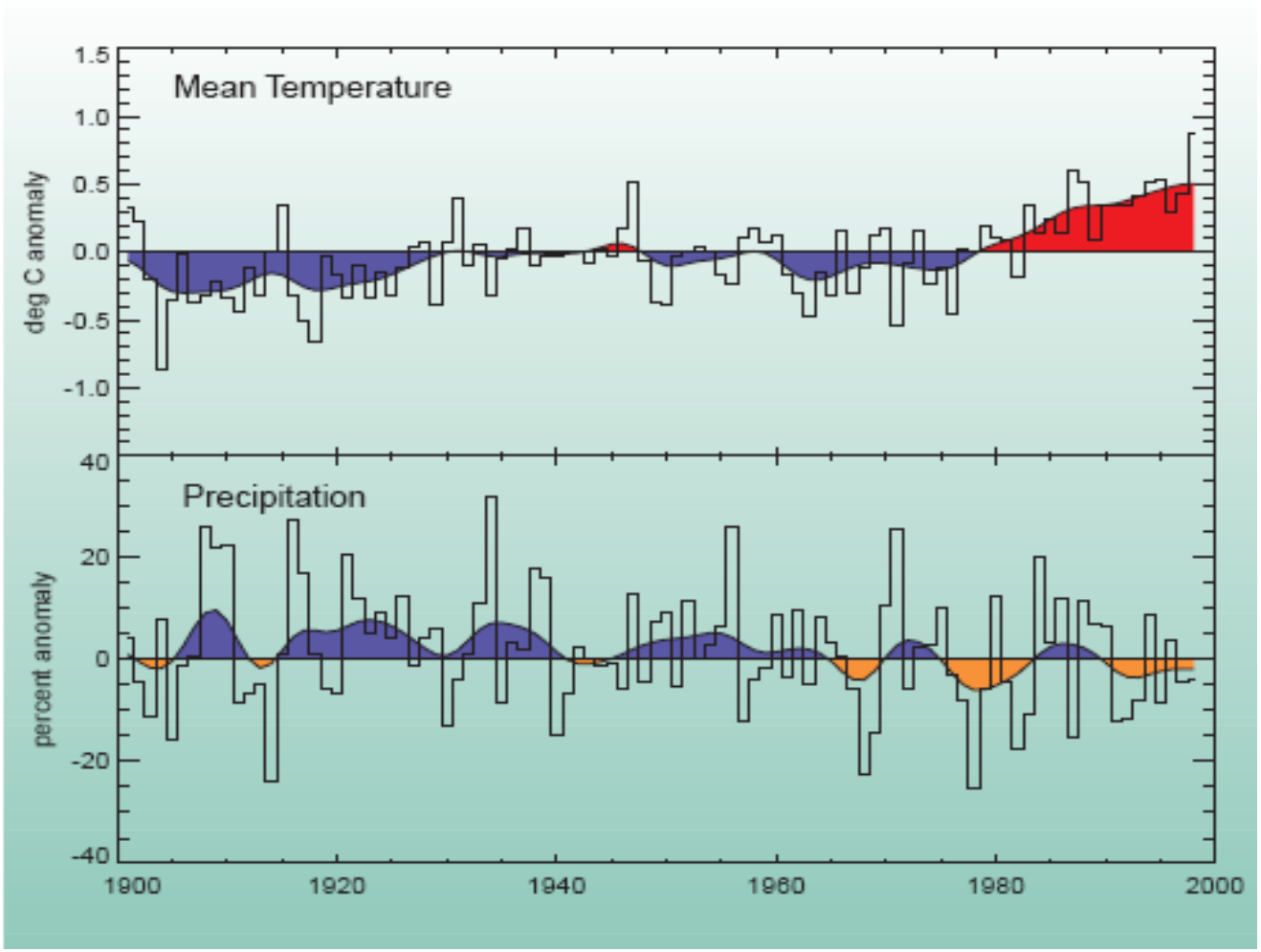
Source: Phil. Department of Agriculture

Manifestations of Climate Change in the Philippines

- Increase in mean temperature
- Decrease in precipitation
- Sea-level rise
- El Nino, La Nina
- Tropical cyclones

Climatic Trends in the Philippines

Annual Temperature and Precipitation in the Philippines: Deviations from Normal

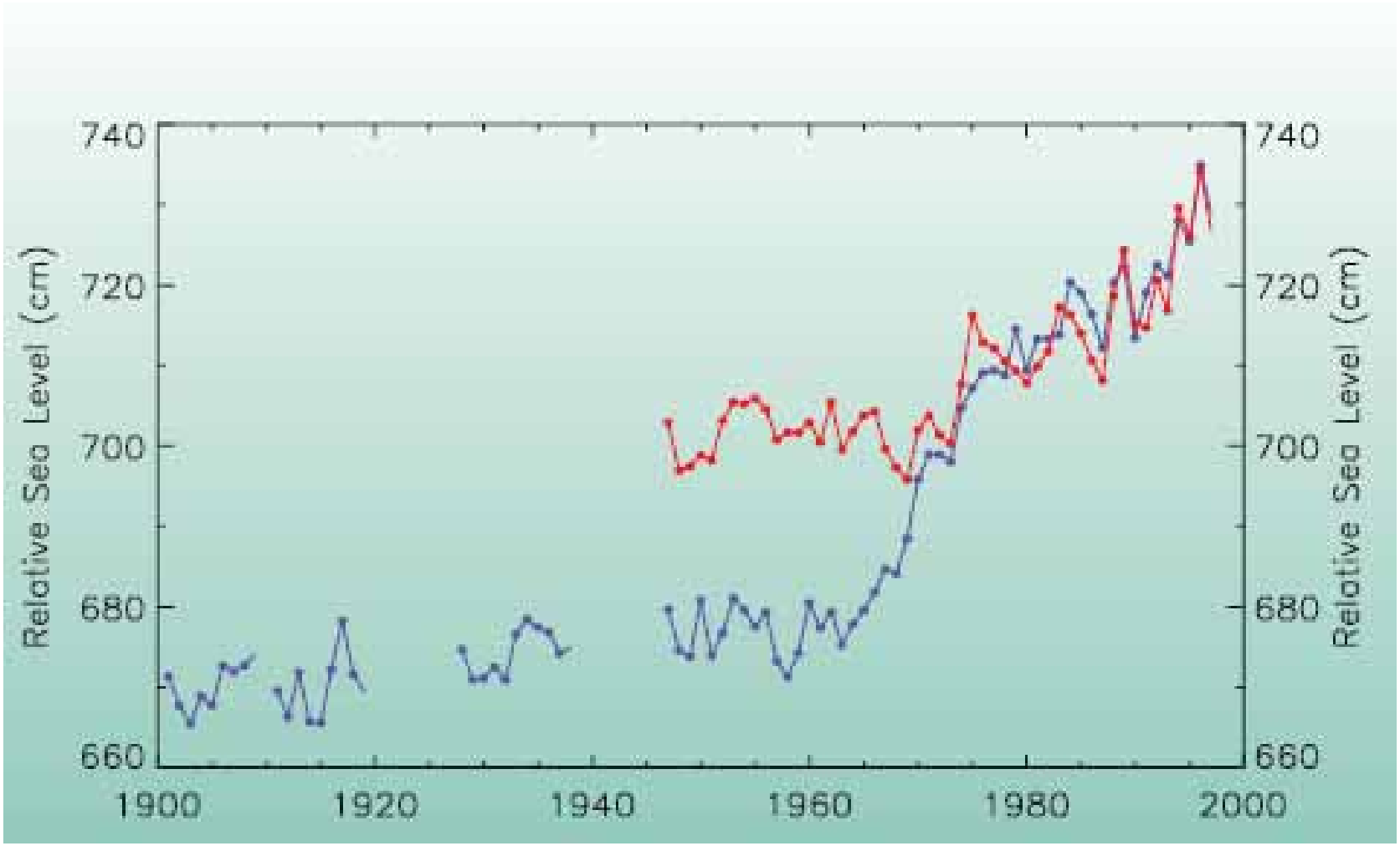


Normal Annual Temp: 25.7°C

Normal Annual Precip: 2,325 mm

Source: Hulme and Sheard (1999)

Relative Annual Mean Sea Level in Manila, South Harbor



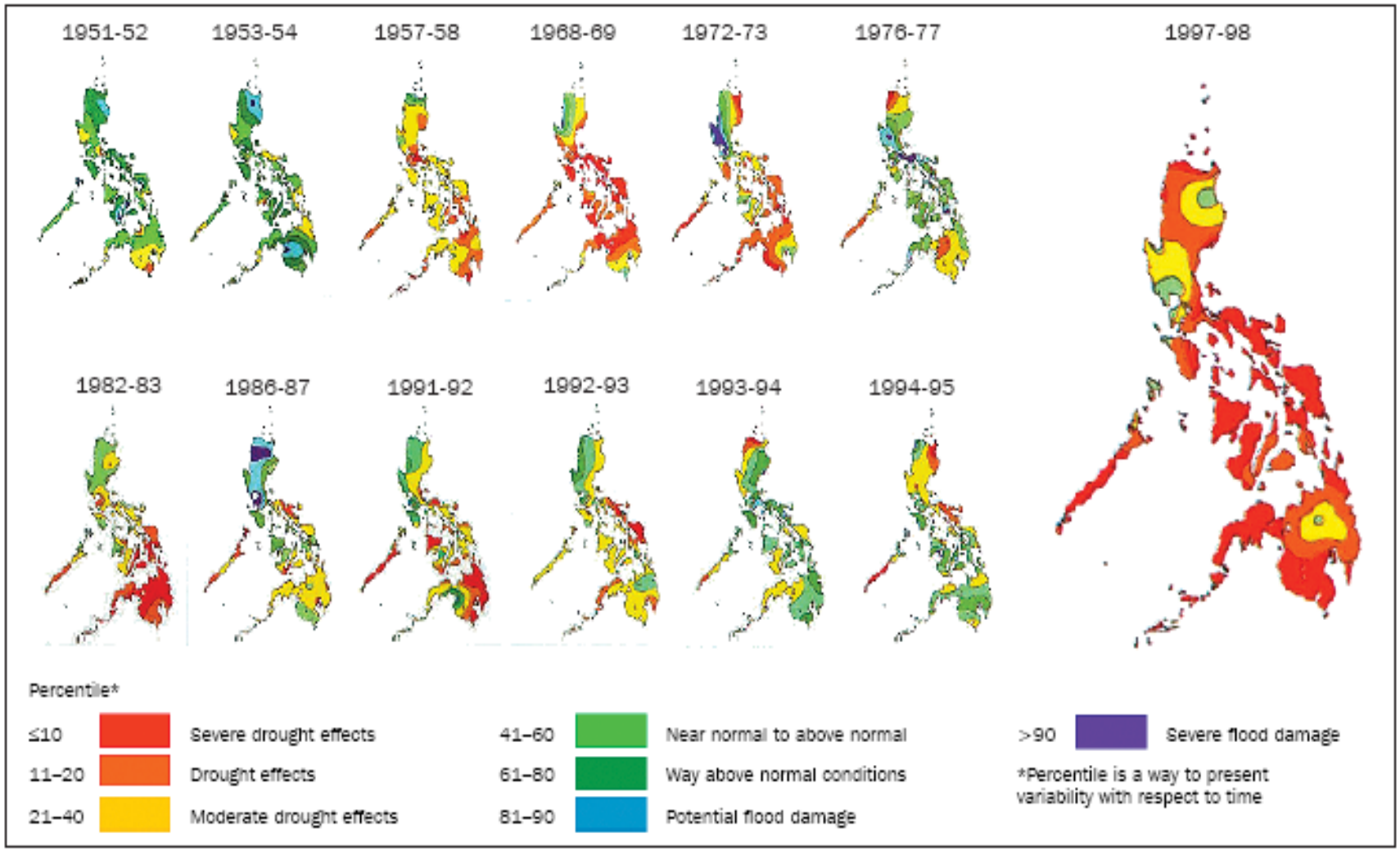
Source: Hulme and Sheard (1999)

Drought Occurrence in the Philippines over the Last 3 Decades

Event	Areas affected
1968-1969	Bicol and the rest of the Philippines except Ilocos and Cagayan Valley
1972-1973	Central Luzon, Visayas and Mindanao
1976-1977	Mindanao except Davao
1982-1983	
(Oct 1982-March 1983)	Central Luzon, southern Tagalog, northern Visayas, western Mindanao, Ilocos, Cagayan Valley, Bicol
(April-September 1983)	Cagayan Valley, parts of Ilocos
1986-1987	
(Oct 1986-Mar 1987)	Western Luzon, Bicol
(April-September 1987)	Most of Luzon, central Visayas, northeastern Mindanao
1989-1990 (Oct 89-Mar 90)	Cagayan Valley, Panay Island, Guimaras, northern Palawan, western Mindanao
1991-1992	Central Luzon, southern Tagalog, northern Visayas, western Mindanao, Cagayan Valley, Parts of Ilocos
1994-1995	Ilocos, Cagayan Valley, central Luzon, southern Tagalog, Visayas, western Mindanao
1997-1998	Northern Mindanao, southern Mindanao, eastern Visayas

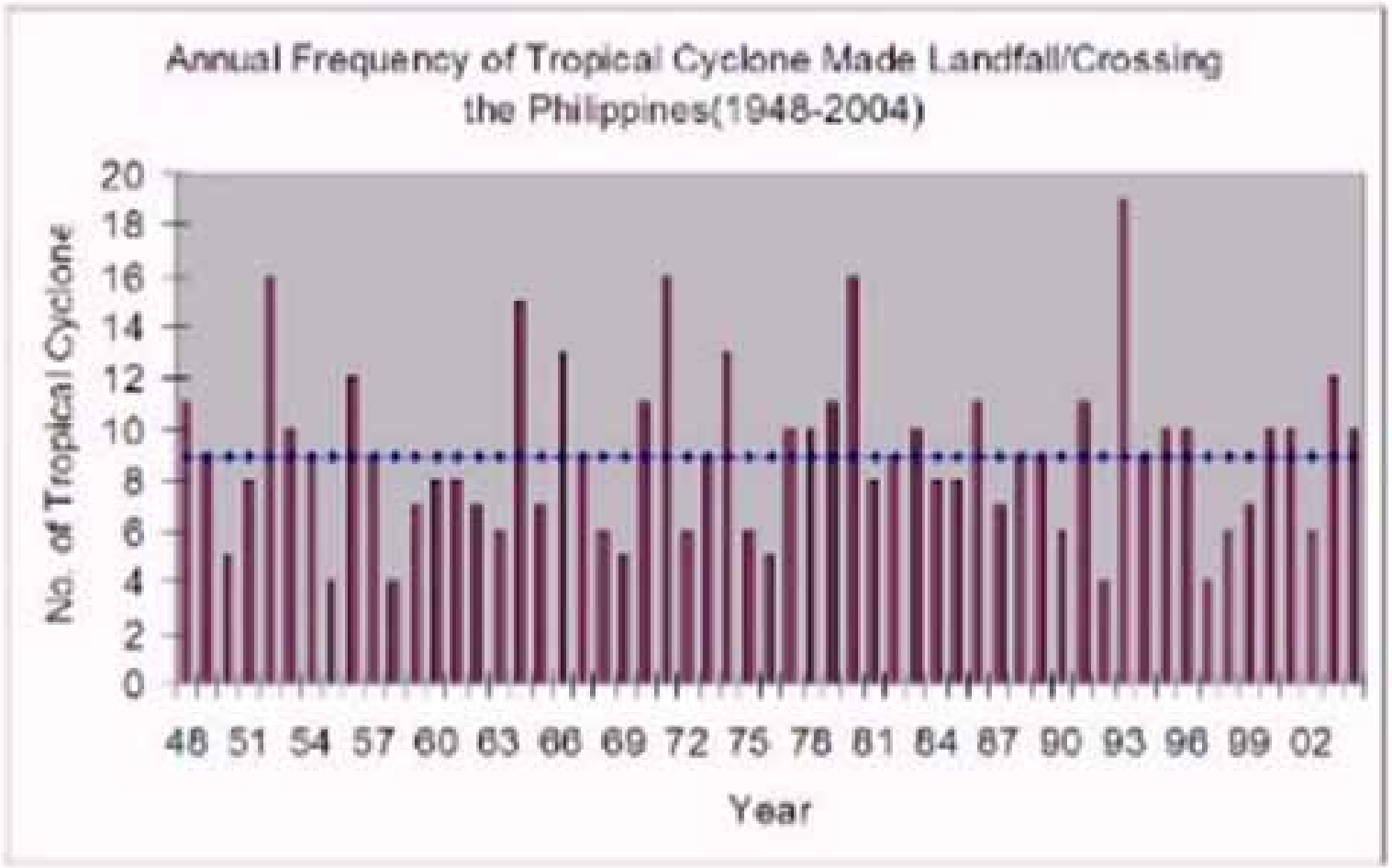
Source: PAGASA and Monsalud et al. (2003)

Spatial and Temporal Variability of Rainfall During El Nino Years in the Philippines



Source: PAGASA and Lansigan (2003)

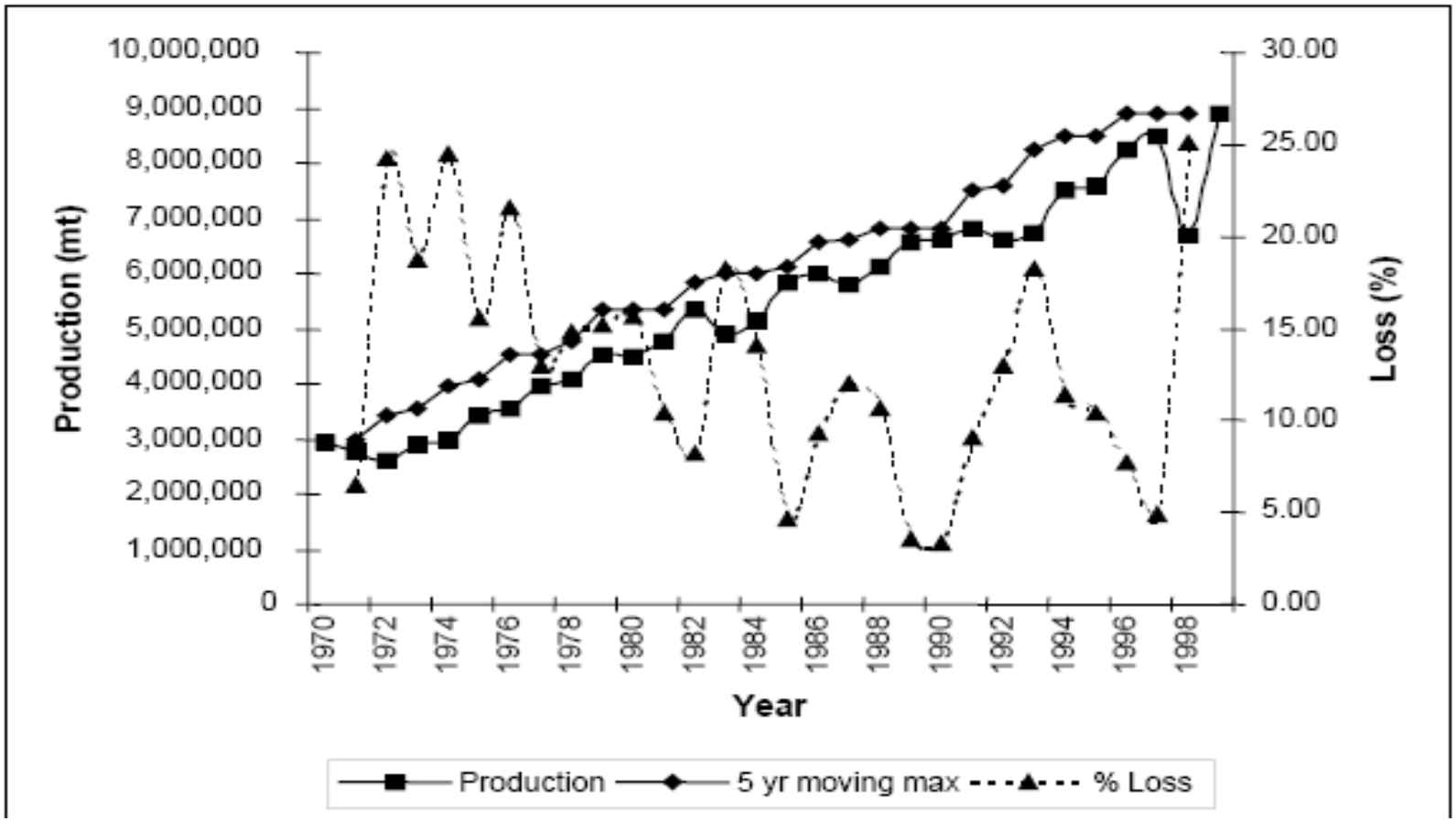
Annual Frequency of Tropical Cyclones that Hit the Philippines



Source: PAGASA

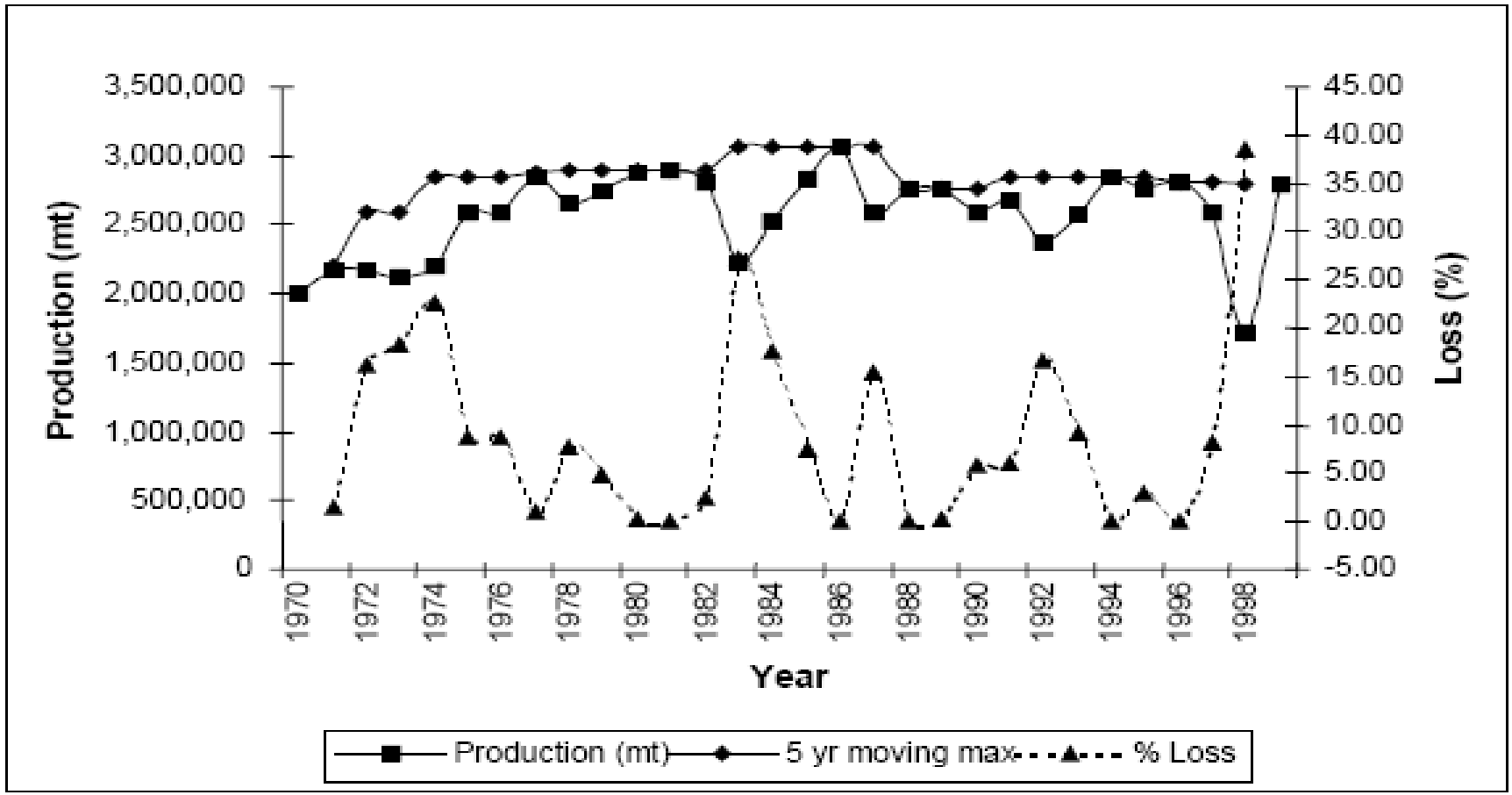
Impact of Climate Change on Agriculture in the Philippines

Estimated Losses in Irrigated Rice Production in the Philippines



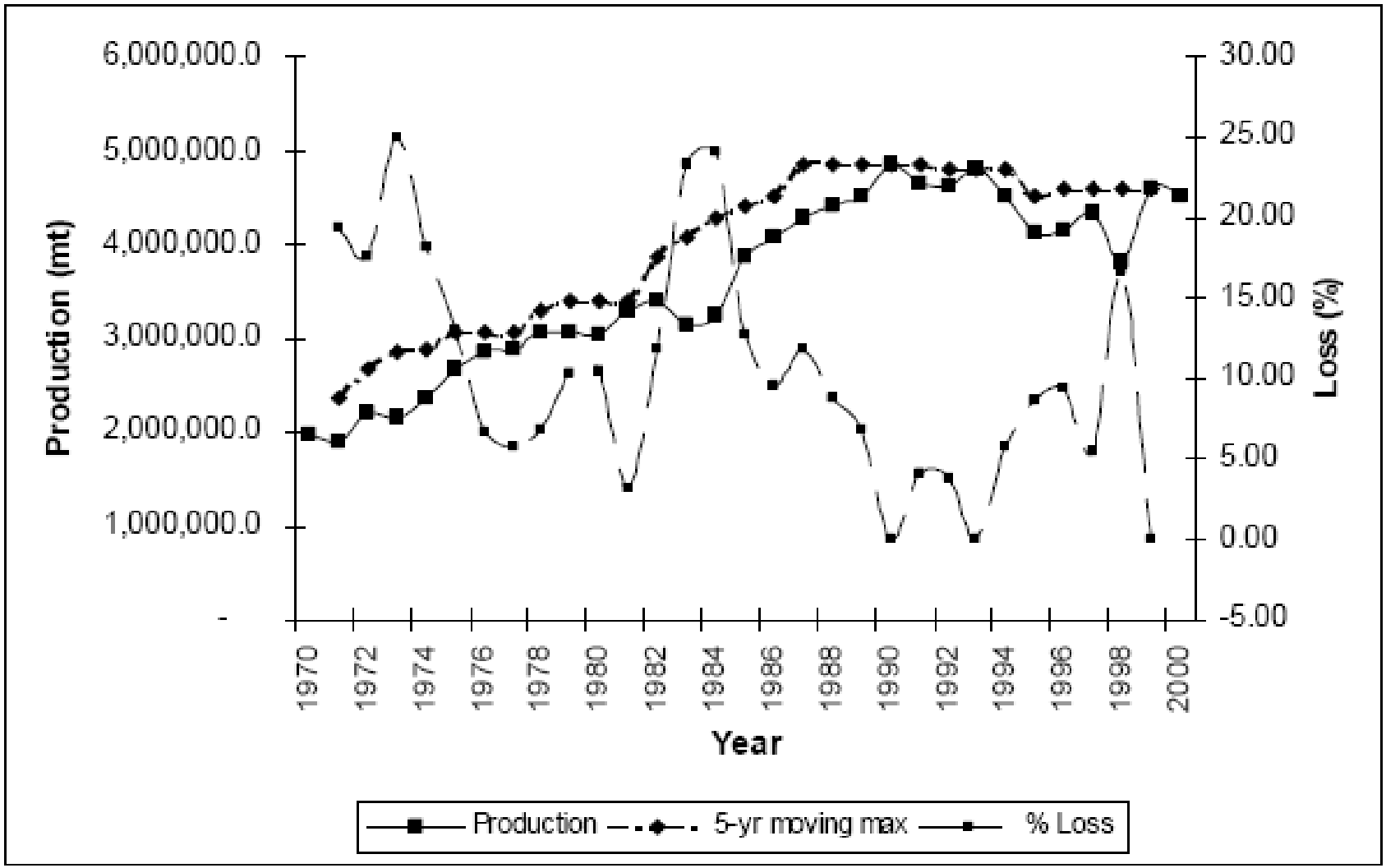
Source: BAS and Monsalud et al (2003)

Estimated Losses in Rainfed Rice Production in the Philippines



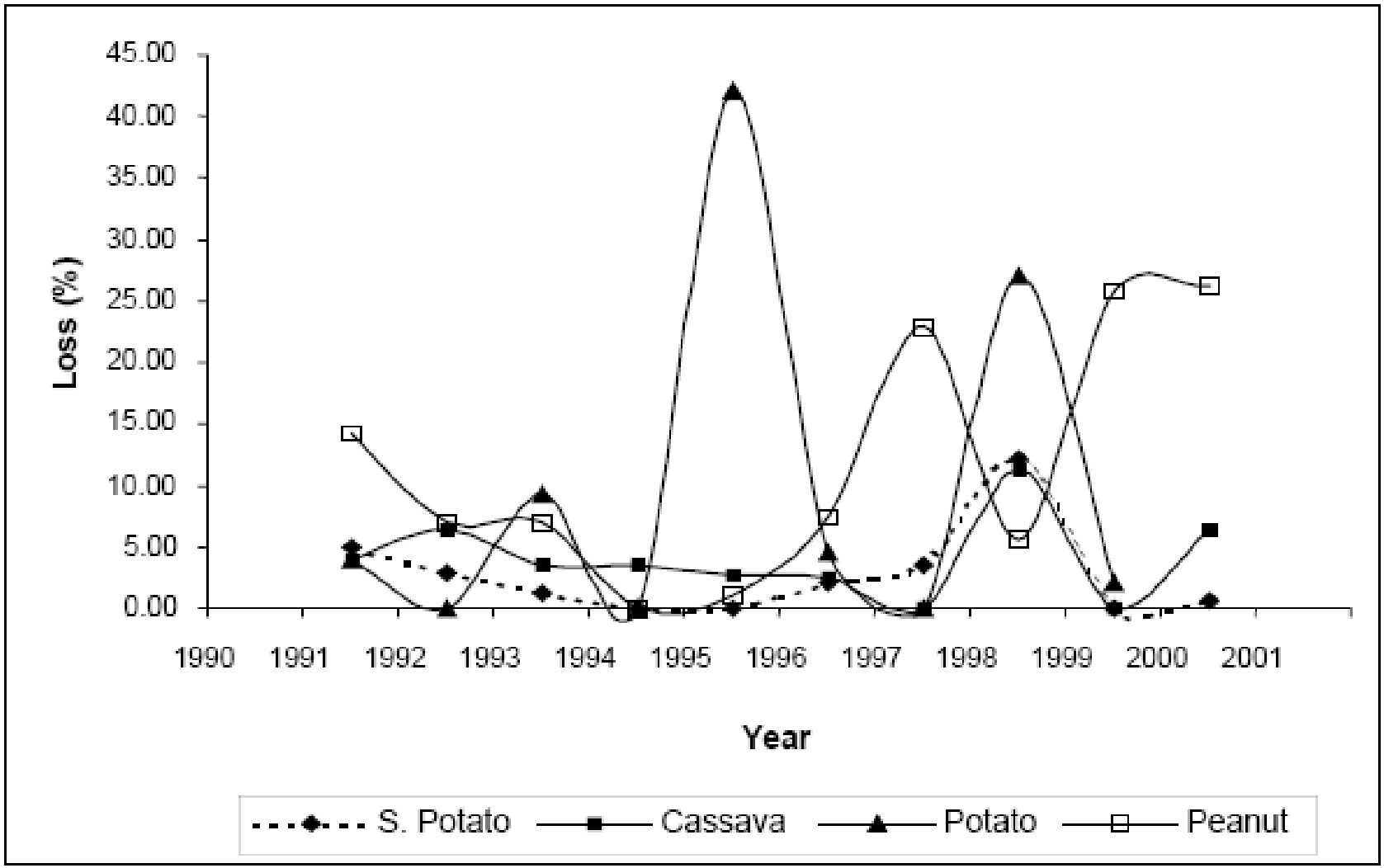
Source: BAS and Monsalud et al (2003)

Estimated Losses in Corn Production in the Philippines



Source: BAS and Monsalud et al (2003)

Estimated Losses in Production of Other Crops in the Philippines

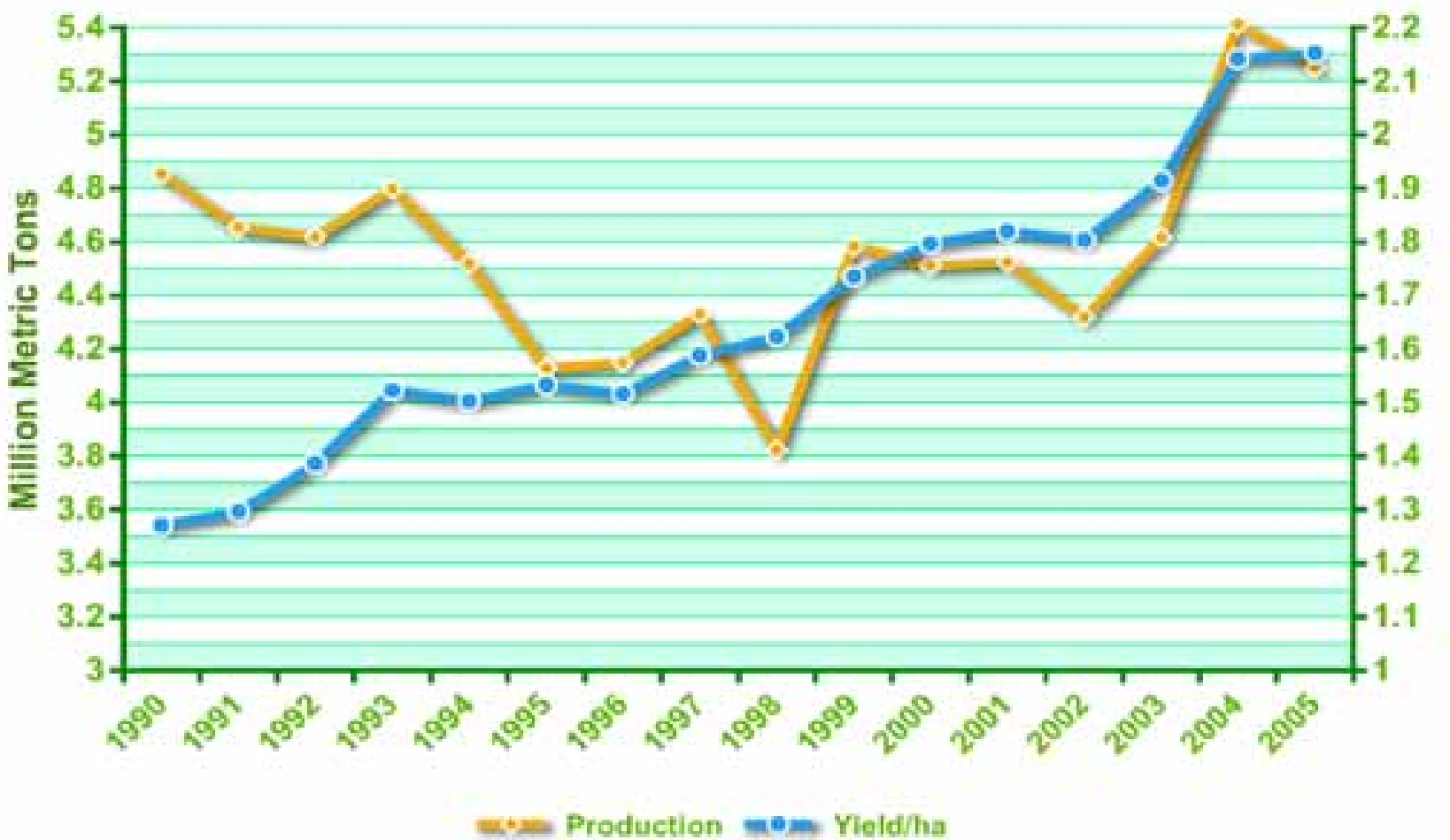


Source: BAS and Monsalud et al (2003)

Trend in Rice Production and Rice Yield in the Philippines

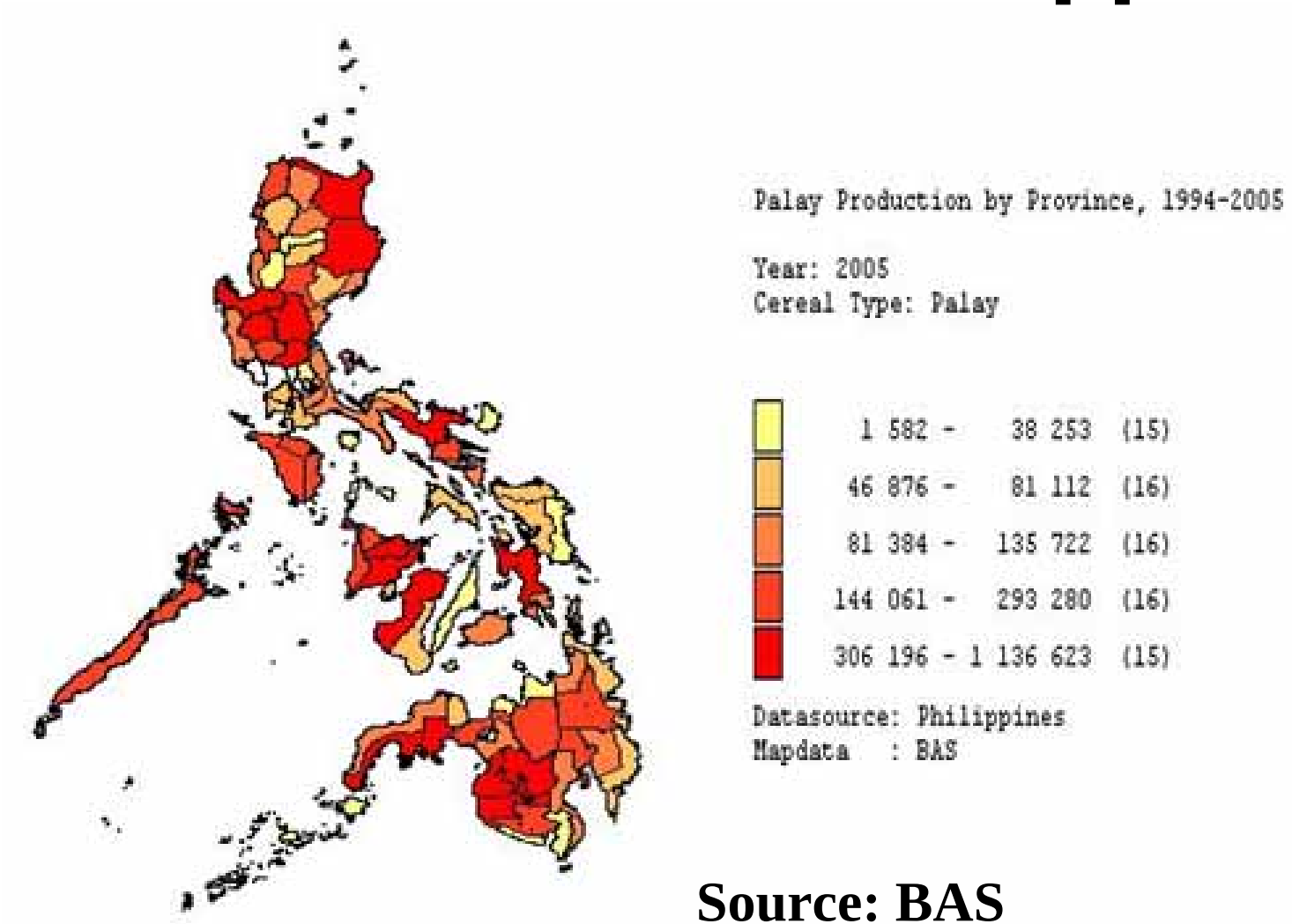
Source: BAS

Trend in Corn Production and Corn Yield in the Philippines



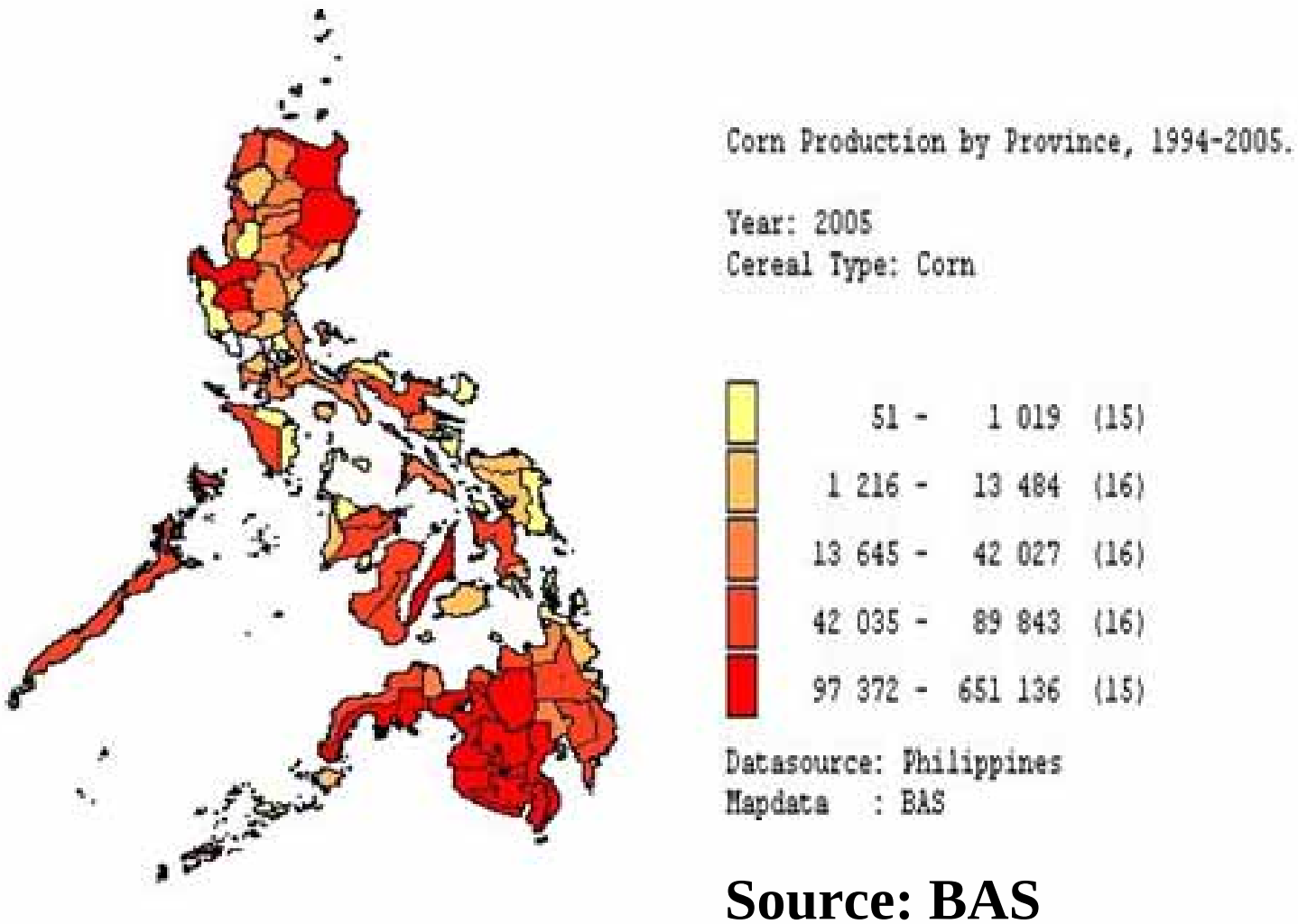
Source: BAS

Spatial Variability of Rice Production in the Philippines



Source: BAS

Spatial Variability of Corn Production in the Philippines



Source: BAS

Agricultural Engineering Technologies for Climate Change Mitigation and Adaptation

Water conservation, water saving and irrigation technologies

- Small Water Impounding Systems
- Small Farm Reservoirs
- Rainwater harvesting
- Small diversion dams
- Shallow tubewell
- Drip irrigation

Small Water Impounding Systems

Typical service area:

25 to 150 has

Typical height: < 30 m

Source: NIA and BSWM

SMALL WATER IMPOUNDING PROJECT/DIVERSION DAM
Summary of Completed Projects by Region
Cumulative 1974-2001
As of December 2001

Region	No.	Service Area (Ha.)	No. of Beneficiaries	Project Cost (P'000)
CAR	147	1,957	2,320	56,723.52
1	160	6,319	5,506	165,168.97
2	134	7,254	5,112	268,877.91
3	143	4,967	3,614	196,785.70
4	109	3,010	3,260	58,609.29
5	120	5,300	5,006	101,163.77
6	105	3,971	2,920	68,919.22
7	37	1,026	1,334	59,539.36
8	124	3,370	1,892	99,587.41
9	66	2,236	1,962	52,219.88
10	74	3,177	2,864	51,881.16
11	84	6,699	3,984	167,199.07
12	65	7,574	3,017	44,813.95
CARAGA	113	3,546	2,575	63,788.79
ARMM	23	808	622	2,650.00
TOTAL	**1,504**	**61,214**	**45,988**	**1,457,928.00**

Source: NIA and BSWM

Small Farm Reservoirs

Typical service area:

0.5 to 1 ha

Typical embankment

height: < 4 m

Source: NIA and BSWM

SMALL FARM RESERVOIR (SFR)
Summary of Completed Projects by Region
Cumulative 1995-2003
As of December 2003

Region	Completed / Operational		
	No.	Service Area (Ha.)	No. of Beneficiaries
CAR	1,825	1,825	1,825
1	3,734	3,734	3,734
2	2,961	2,961	2,961
3	5,903	5,903	5,903
4	718	718	718
5	385	385	385
6	1,009	1,009	1,009
7	837	837	837
8	1,081	1,081	1,081
9	876	876	876
10	538	538	538
11	795	795	795
12	1,274	1,274	1,274
CARAGA	325	325	325
ARMM	21	21	21
TOTAL	**22,282**	**22,282**	**22,282**

Source: NIA and BSWM

Rainwater Harvesting

Source: Anonymous

Small Diversion Dams

Typical height:

0.50 - 2.00 meters

Typical service Area: about 40 hectares.

Source: NIA

SMALL DIVERSION DAM (DD)
Summary of Completed Projects by Region
Cumulative 1974-2003
As of December 2003

Region	Completed / Operational		
	No.	Service Area (Ha.)	No. of Beneficiaries
CAR	138	1,794	2,142
1	115	4,625	4,146
2	36	1,972	1,076
3	63	1,913	1,357
4	96	3,209	3,268
5	88	3,996	3,953
6	102	3,663	2,853
7	26	1,016	894
8	65	2,755	1346
9	49	1,566	1,432
10	58	2,780	2,528
11	57	4,341	2,498
12	63	8,465	3,478
CARAGA	86	3,276	2,441
ARMM	2	115	70
TOTAL	**1,044**	**45,486**	**33,482**

Source: NIA and BSWM

Shallow Tubewells

Typical Depth:

6 to 18 m

Typical Service Area:

3 to 5 has

SHALLOW TUBEWELL (STW)
Summary of Completed Projects by Region
Cumulative 1995-2003
As of December 2003

Region	Completed / Operational		
	No.	Service Area (Ha.)	No. of Beneficiaries
CAR	1,185	3,555	2,370
1	4,616	13,848	9,232
2	3,830	11,490	7,660
3	5,168	15,504	10,336
4	2,069	6,207	4,138
5	1,648	4,969	3,255
6	2,611	7,833	5,155
7	804	2,412	1,608
8	1,083	3,249	2,166
9	1,127	3,381	2,254
10	1,432	4,296	2,864
11	1,605	4,815	3,210
12	1,126	3,378	2,252
CARAGA	1,078	3,234	2,156
ARMM	780	2,340	1,560
TOTAL	**30,162**	**90,511**	**30,216**

Source: NIA and BSWM

Drip Irrigation

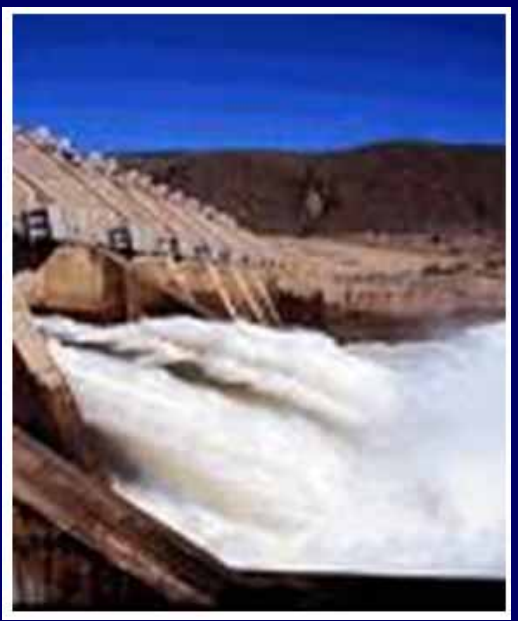
Sources: SANREM, USAID and PCARRD

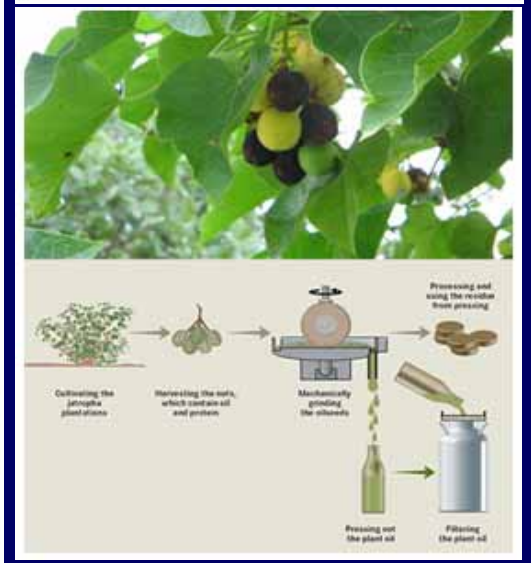
Soil erosion control and soil conservation technologies

- Bench terraces
- Rockwalls
- Drainage canals
- Contour ditches

Energy Production technologies

- Renewable energy
- Biofuels





Agricultural Waste Management Technologies

- Crop residue management
- Livestock waste management

Other AE technologies

- Computer simulation modeling
- Weather forecasting
- Remote sensing

POLICY INITIATIVES in the PHILIPPINES

- Creation of Inter-Agency Committee on Climate Change (May 1991)
- Signing of UN Convention on Climate Change (signed in June 1992 and ratified on August 2, 1994)
- Signing of Kyoto Protocol (signed on April 15, 1998 and ratified on November 20, 2003)

Source: Ouano (2007)

POLICY INITIATIVES in the PHILIPPINES (cont'd)

- **Designation of the Department of Environment and Natural Resources (DENR) as the National Authority for Clean Development Mechanism (CDM) on June 20, 2004 thru Executive Order 320**
- **Creation of Presidential Task Force on Climate Change thru Administrative Order No. 171 on February 20, 2007**

Source: Ouano (2007)

RECOMMENDATIONS

- More research on climate change mitigation and adaptation in the Philippines geared towards sustainable agriculture using modern techniques

- Greater involvement of agricultural engineers in climate change mitigation and adaptation

RECOMMENDATIONS (cont'd.)

- Policy-makers involved in climate change issues in the country should tap agricultural engineers, hydrologists and simulation modelers so as to provide a sound basis for additional policy formulation in the country
- Strict implementation of policies on climate change mitigation and adaptation should be enforced

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