

THAI AGRICULTURE: GOLDEN CRADLE OF MILLENNIA

by Professor Lindsay Falvey

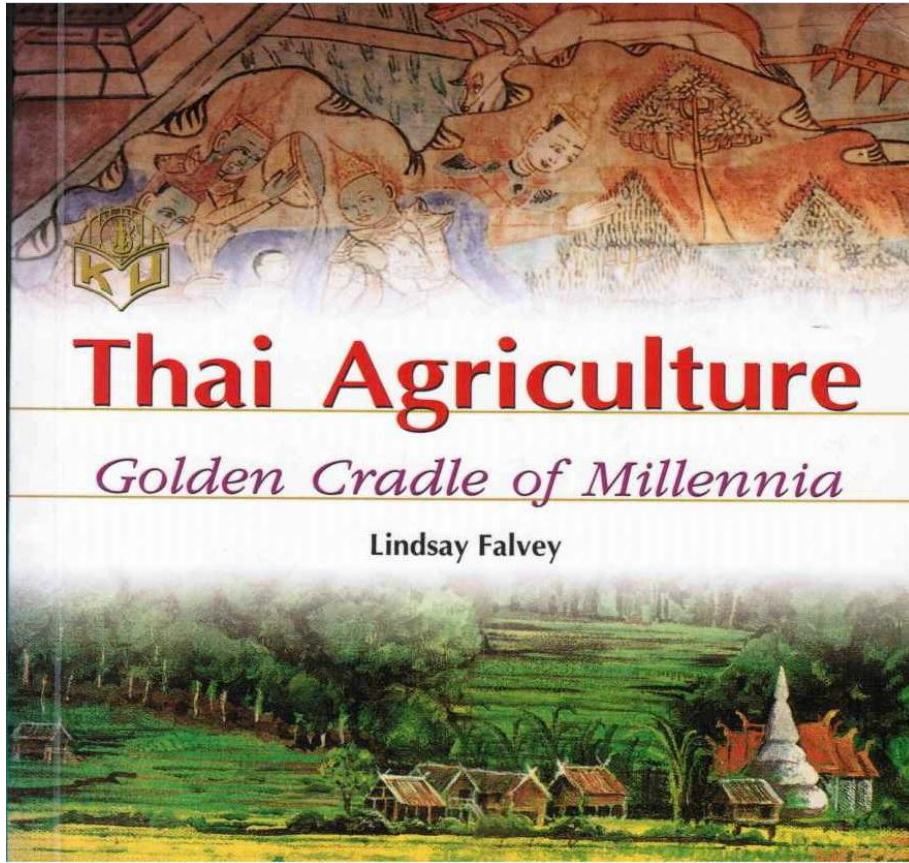
Chair of Agriculture, University of Melbourne.

Published 2000 by Kasetsart University Press.

EE 460: Thai Economy

Semester 1 / 2019

Faculty of Economics, Thammasat University



'Indispensable definitive reference on Thai agriculture and the environment...'

Introduction

Agriculture is important to Thailand, and Thai agriculture is important to the world. It can be briefly characterised in the following terms:

- As one of the world's largest rice exporters, and high ranking exporter of other food stuffs, Thailand feeds some four times its population; that is something around 250 million people.
- As the world's largest rubber producer and exporter, Thailand supports global industries particularly in more developed countries, and influences rubber marketing policies.
- As the world's largest producer and exporter of Black Tiger Prawns, Thailand dominates one of the few agricultural sectors which continues to experience rising prices.
- One Thai multi-national group, Charoen Pokaphan has grown to become the region's largest agribusiness conglomerate, ranking in the world's ten largest such firms.
- Thailand is the region's largest exporter of chicken meat and dominates the Japanese market.

Source: Directly quoted from Falvey (2000)

Introduction (continued)

- An estimated 80 percent of Thai persons are engaged in agriculture and its industries.
- Overwhelmingly, the managers of the natural environment of Thailand are farmers, and fishers.
- The national identity has developed around symbols of agricultural bounty consumed responsibly through images of abundant rice and fish in a benign environment.
- The Chaophraya River valley developed for irrigated rice production has symbolised an approach to sustainable production.
- Thailand has enjoyed foreign investment and relative political stability which have supported development of an infrastructure oriented to agricultural production for export.
- Over-production of fish, timber, and agricultural commodities has recently degraded the natural environment in which the majority of the population live necessitating informed adaptation of agricultural practices to meet social and environmental needs.

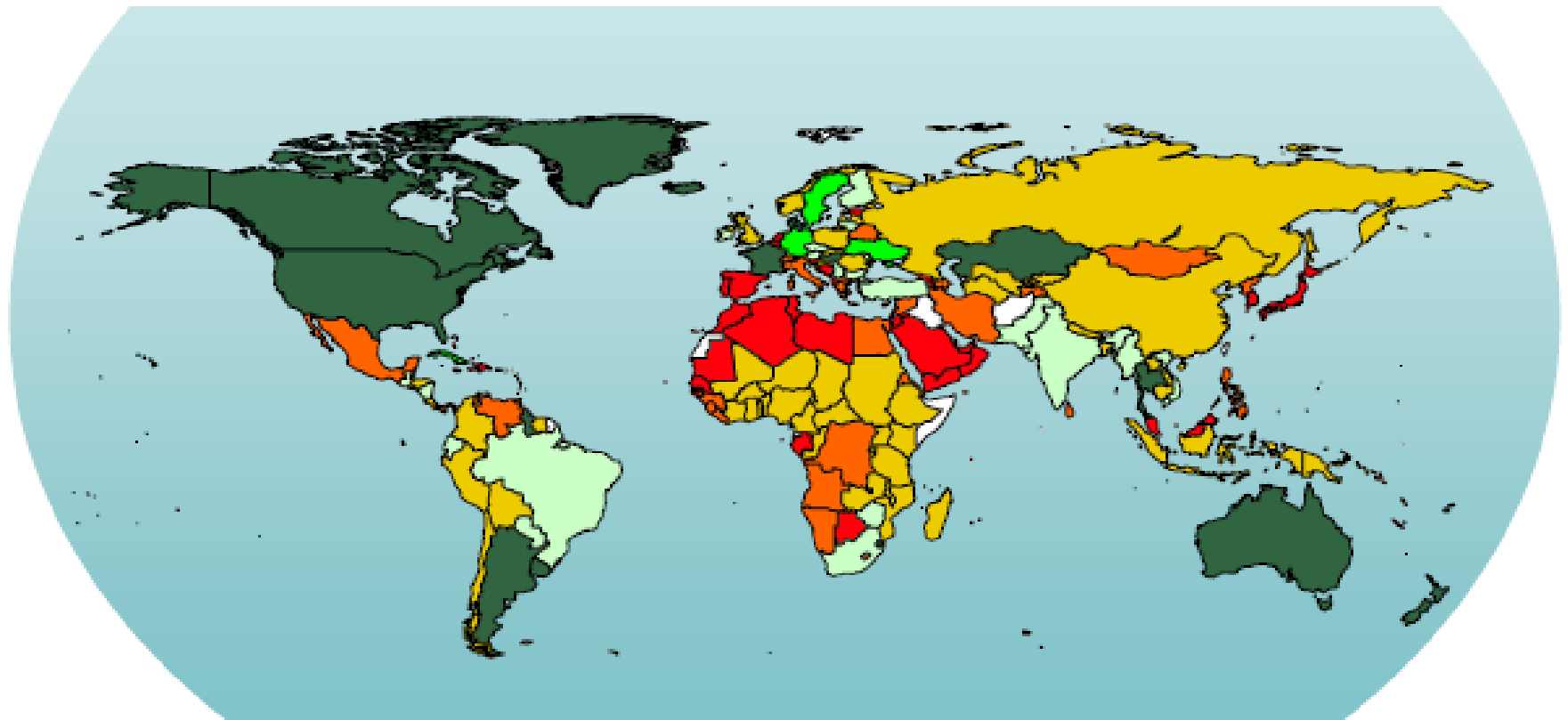
التجارة الصافية في الأغذية

食品贸易净额

Net trade in food

Commerce net de produits alimentaires

Comercio neto de alimentos



2000-2002



Introduction (continued)

- Thailand is one of the world's seven major agricultural exporters which separates it from its neighbours and allows an interpretation of; its economic responses to world and regional events, cultural associations with agriculture and rice in particular, and the types of manufacturing industry which underpin further industrial development.
- However, agriculture has declined in economic importance worldwide, and agricultural commodity prices indicate a long term trend of decline. In terms of share of gross world product, agriculture has fallen from around 90 percent at the end of the eighteenth century to around eight percent at the end of the twentieth century.
- The relationship between decline in contribution of agriculture to a country's economy and its economic growth has spawned a view that agriculture should be of declining importance if the country is to develop. This view may be wrong in many cases, especially for Thailand.

Introduction (continued)

- With a population of around 61 million people, Thailand's population density of 120 people per square kilometre compares with a global figure of 45; other low-middle income countries average 25, and the East Asia and Pacific region averages 114.
- Such a significant agricultural nation has emerged from specific human and natural resources. Thailand can therefore be considered in terms of its natural environment, its modified agricultural environment, and its people and their development of an agricultural nation.
- The golden cradle of this civilisation includes the essential ingredients of a sustainable agriculture, which have been apparently abundant natural resources of land and water and a favourable climate.

The Land of the Thai

- Located between 5°40' and 20°30' North latitude and 97°70' and 105°45' East longitude with a total area of some 513,112 square kilometres. (approximately 320,697,000 rai), Thailand borders Lao-PDR to the north and east, Myanmar to the north and west, Cambodia to the southeast, and Malaysia to the south.
- It has some 2,614 kilometres of coastline and a maximum length north to south length of some 1,620 kilometres.

The Land of the Thai (continued)

- Administratively, the country is often divided into four regions plus Bangkok although a six way physiographic division provides a more convenient basis for some discussions.
- The six divisions are the Central Plain, Southeast Coast, Northeast Plateau, Central Highlands, North and West Continental Highlands, and Peninsula Thailand as indicated in Figure 1.1.
- The Central Plain is the large alluvial delta of the Chaophraya system comprising quaternary alluvial deposits which exceed 300 meters in depth.
- The Southeast coast is comprised of quaternary terraces predominantly of marine origin interspersed with alluvial deposits and also contains a minor volcanic plateau.

The Land of the Thai (continued)

- The Northeast plateau comprises wide river terraces of the Mekong River and tributaries and is commonly separated into low, middle and high terraces, the latter of which has largely disappeared.
- The Central Highlands is a complex region comprising hills plateaux, peneplains, and valleys across altitudes of 300 to 1,200 meters.
- The north and west Continental Highlands is commonly separated into the western mountains of the Central Cordillera, and the northern hills and valleys which is a series of north-south mountains and plateau interspersed with long flat river basins.
- Peninsular Thailand comprises several distinct mountain ranges and low hills and undulating terraces of fluvial origin.

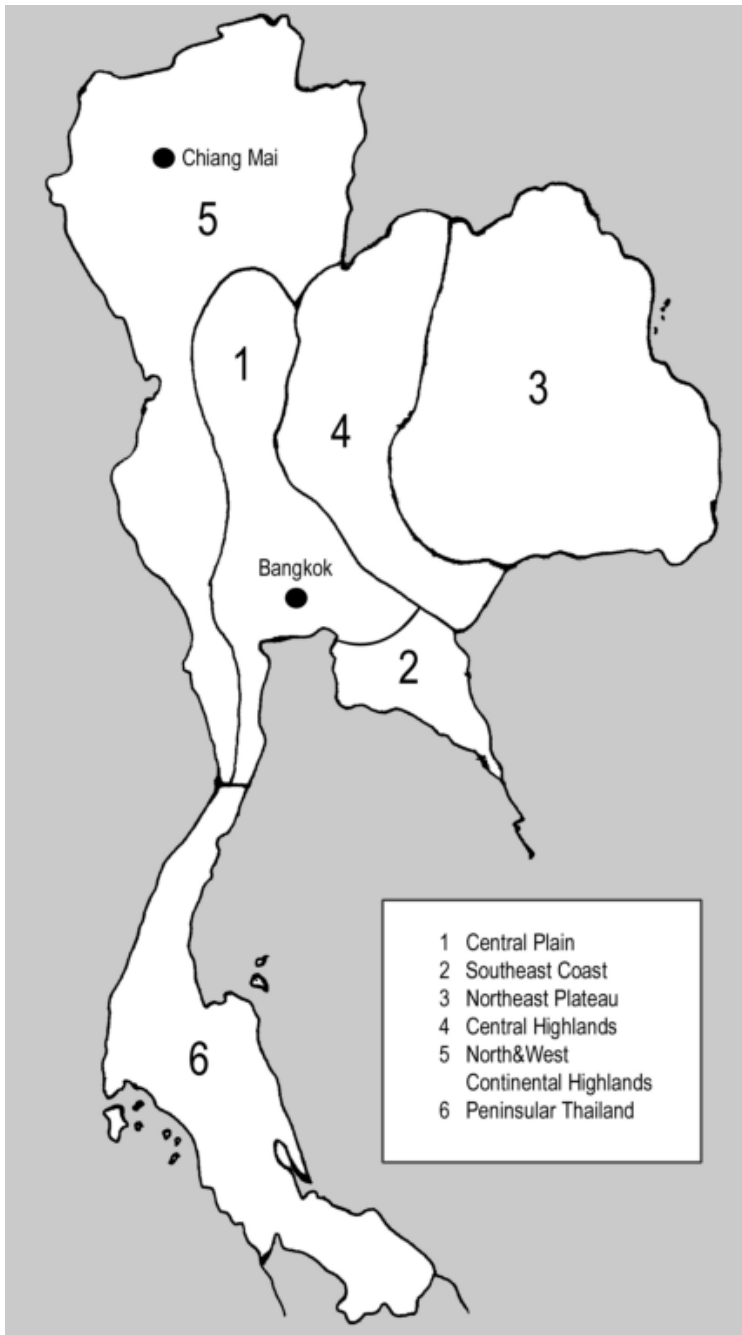


Figure 1.1: Six Physiographic Divisions of Thailand

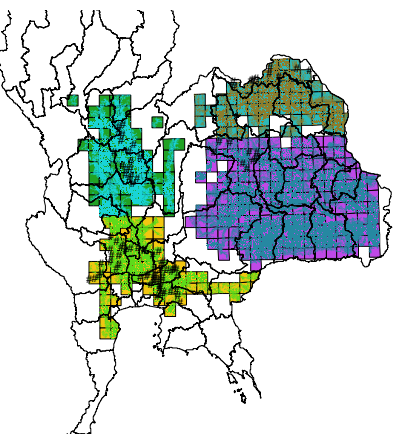
Source: Falvey (2000)



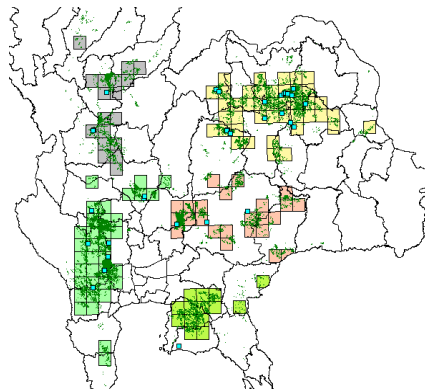
- Thailand is located in Southeast Asia region
- Country area **51,312,000 hectares**
- Agriculture area base on land-use data **23,877,800 hectares (46.5% of country area)**
- Paddy field area **8,930,006 hectares (37.4% of agricultural land area)**
- Irrigated paddy field area **2,792,000 hectares (31.3% of paddy field area)**

Source: Office of Agricultural Economics

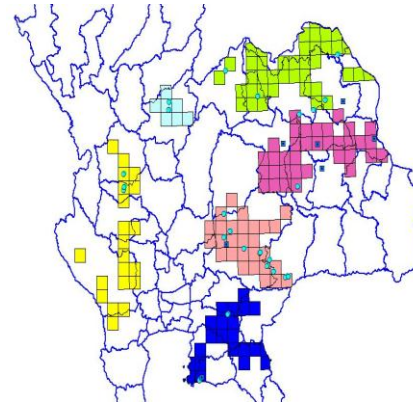
Main areas of cultivating major crops



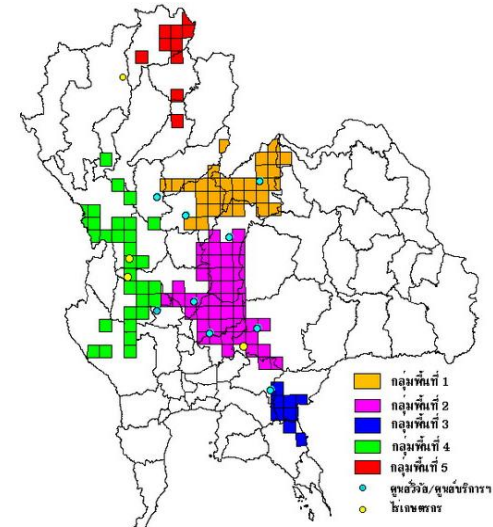
Rice



Sugar cane









Cassava



Maize

Source: Southeast Asia START Regional Center

Crop season

Crops		Explanation	Harvest season																																																												
Rice		2 time harvesting Major and Second	<table border="1"> <thead> <tr> <th></th> <th>1</th><th>2</th><th>3</th><th>4</th><th>5</th><th>6</th><th>7</th><th>8</th><th>9</th><th>10</th><th>11</th><th>12</th> <th>1</th><th>2</th><th>3</th><th>4</th><th>5</th><th>6</th><th>7</th> </tr> </thead> <tbody> <tr> <td>Rice(Major)</td> <td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td> <td></td><td></td><td></td><td></td><td></td><td></td><td></td> </tr> <tr> <td>Rice(Second)</td> <td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td> <td></td><td></td><td></td><td></td><td></td><td></td><td></td> </tr> </tbody> </table>		1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	Rice(Major)																				Rice(Second)																			
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Cassava		Raw Material for biofuel, animal feed etc.	<table border="1"> <thead> <tr> <th></th> <th>1</th><th>2</th><th>3</th><th>4</th><th>5</th><th>6</th><th>7</th><th>8</th><th>9</th><th>10</th><th>11</th><th>12</th> <th>1</th><th>2</th><th>3</th><th>4</th><th>5</th><th>6</th><th>7</th> </tr> </thead> <tbody> <tr> <td>Cassava</td> <td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td> <td></td><td></td><td></td><td></td><td></td><td></td><td></td> </tr> </tbody> </table>		1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	Cassava																																							
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Sugarcane		Raw Material for Sugar, biofuel etc.	<table border="1"> <thead> <tr> <th></th> <th>1</th><th>2</th><th>3</th><th>4</th><th>5</th><th>6</th><th>7</th><th>8</th><th>9</th><th>10</th><th>11</th><th>12</th> <th>1</th><th>2</th><th>3</th><th>4</th><th>5</th><th>6</th><th>7</th> </tr> </thead> <tbody> <tr> <td>Sugarcane</td> <td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td> <td></td><td></td><td></td><td></td><td></td><td></td><td></td> </tr> </tbody> </table>		1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	Sugarcane																																							
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Maize		Food, Flour, animal feed, biofuel etc.	<table border="1"> <thead> <tr> <th></th> <th>1</th><th>2</th><th>3</th><th>4</th><th>5</th><th>6</th><th>7</th><th>8</th><th>9</th><th>10</th><th>11</th><th>12</th> <th>1</th><th>2</th><th>3</th><th>4</th><th>5</th><th>6</th><th>7</th> </tr> </thead> <tbody> <tr> <td>Maize</td> <td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td> <td></td><td></td><td></td><td></td><td></td><td></td><td></td> </tr> </tbody> </table>		1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	Maize																																							
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North

- Paddy field: 2.88M ha
- Harvesting: 1time/year
(Irrigated area: 2time/year)
- Rice, Vegetable, etc

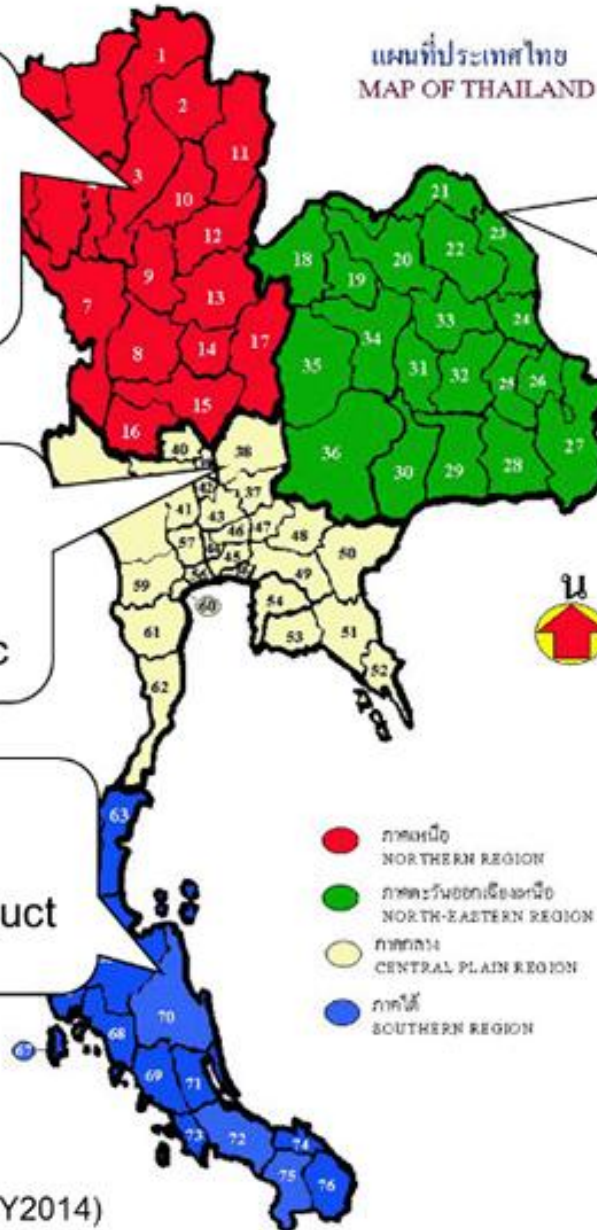
Central

- Paddy field: 1.92M ha
- Harvesting: 2.5time/year
- Rice, Cassava, Sugar cane etc

South

- Paddy field: 0.16M ha
- Palm & Rubber are Major product

แผนที่ประเทศไทย
MAP OF THAILAND



North East

- Paddy field: 5.76M ha
- Harvesting: 1time/year
- Rice, Cassava, Sugar cane

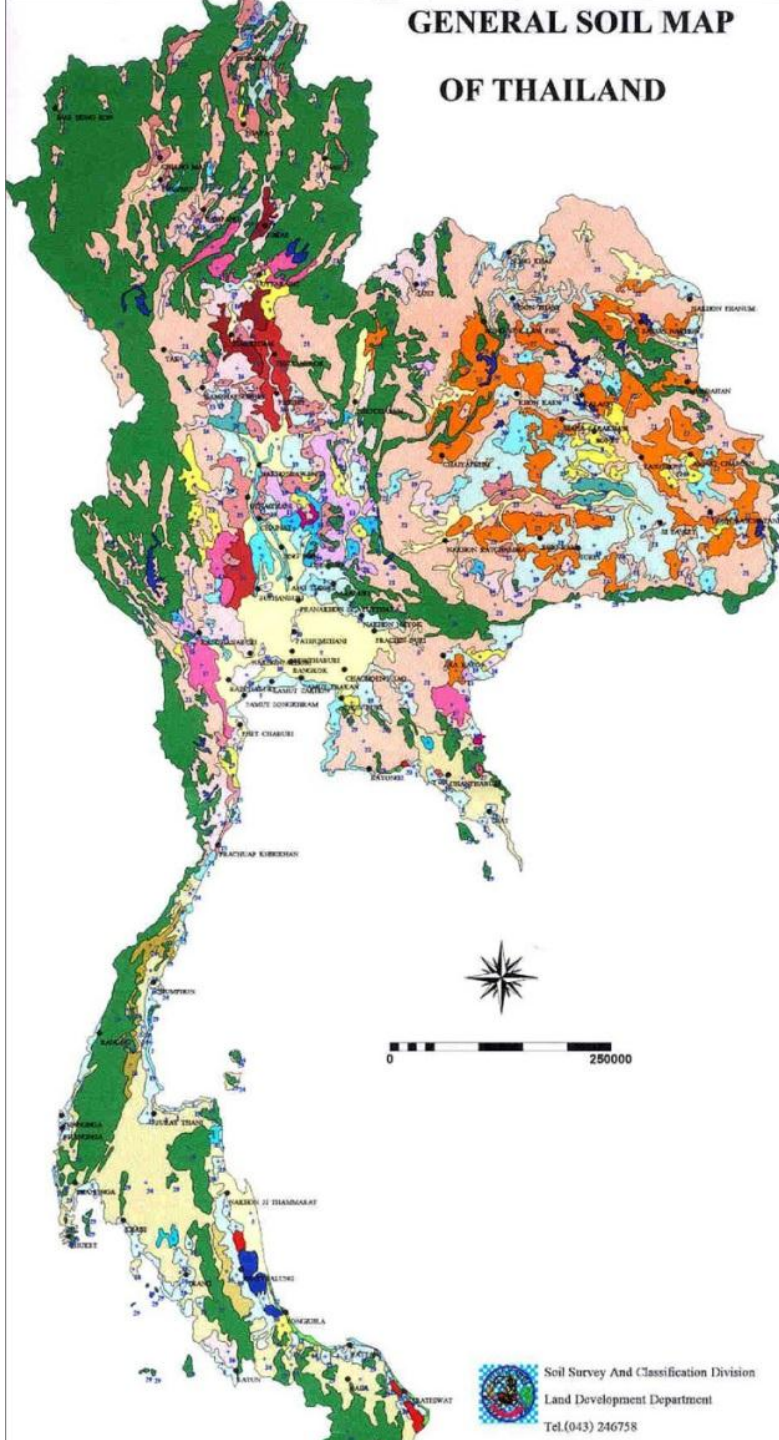


Source: Office of Agricultural Economics (FY2014)

Soil

- Land forms of Thailand can be divided into; beach and dune formations, low and high alluvial terraces, dissected erosion surfaces, hills and mountains, and depressions in a system which builds on the Pendleton Provisional Map of Soils and Surface Rocks of Siam of 1935.
- Detailed land capability maps which began to emerge in the 1960s have usually divided Thailand into areas suited to both paddy and upland crops, upland crops, and areas not generally suited for cultivation.
- While useful definitions in the past, changing demands, environmental impacts of large scale developments, and a rising focus on forestry in both agricultural and conservation areas now requires more manipulable information.

GENERAL SOIL MAP OF THAILAND



SUBORDERS LEGEND

- 1: AQUENTS
- 2: PSAMMENTS
- 3: FLUVENTS
- 4: FLUVENTS/AQUEPTS
- 5: ORTHENTS
- 6: UDERTS
- 7: USTERTS
- 8: AQUEPTS
- 9: TROPEPTS
- 10: AQUOLLS
- 11: USTOIS
- 12: HUMODS
- 13: AQUALFS
- 14: AQUALFS/AQUEPTS
- 15: AQUALFS/USTALFS
- 16: USTALFS
- 17: USTALFS/USTULTS
- 18: UDALFS
- 19: AQUULTS
- 20: AQUULTS/AQUALFS
- 21: USTULTS
- 22: USUTULTS/AQUULTS
- 23: HUMULTS
- 24: UDULTS
- 25: UDULTS/AQUULTS
- 26: UDULTS/ORTHENTS
- 27: ORTHOX
- 28: FIBRISTS
- 29: SLOPE COMPLEX
- 30: WATER

250000
100000
950000
800000
650000
500000
350000
200000
050000
900000
750000

Source:

http://www.idd.go.th/web_eng56/Soil_Resource/Soil_map_and_related/Soil-Taxonomy-1979.jpg

Soil Survey And Classification Division
Land Development Department
Tel.(043) 246758

Soil (continued)

- The general soil map of Thailand presents ten general soil categories (Table 1.2) containing 38 groups.
- The proportions of agricultural land suited to various crops have been suggested as; upland crops 21 percent, paddy rice 26 percent, perennial crops five percent, special crops with appropriate soil enhancement measures 16 percent, with the remaining 31 percent being classified as unsuitable for agriculture.
- The lack of congruence of these areas with current land use reflects population, political, and commercial pressures, and also indicates areas of environmental concern.
- With changes in agricultural technology and population, a gradual shift from mono-cropping of rice has occurred.
- For example, in 1960, 60 percent of the cultivated area was under rice, 12 percent under upland crops, and 16 percent under tree crops of which forest cover represented some 60 percent. By 1993, the area cultivated for upland crops had quadrupled representing 26 percent of cultivated land at the expense of forest land.

Soil (continued)

Table 1.2 Soils in Thailand

Soil Type	Square Kilometres	Million Rai	Percent
Entisols	16,860	10.5	3.29
Vertisols	4,156	2.6	0.81
Inceptisols	48,253	30.2	9.40
Mollisols	6,003	3.8	1.17
Spodosols	615	0.4	0.12
Alfisols	4,6991	29.4	9.16
Ultisols	21,6192	135.1	42.13
Oxisols	153	0.1	0.03
Histosols	718	0.4	0.14
Unclassified	173,174	108.2	33.75
Total	513,115	320.7	100.00

Source: Land Development Department (1972)

Main crops

	Rice	Cassava	Sugar cane	Rubber	Palm oil
% as of total agri areas	53.85%	5.68%	5.06%	12.51%	2.20%
Numbers of households	4,150,400	480,484	200,000	1,259,002	108,386
World Market share	34.91% (#1)	70% (# 1)	9.61% (#2)	42.54% (#1)	0.99 % (#3)

Source: Office of Agriculture Economics (2008)

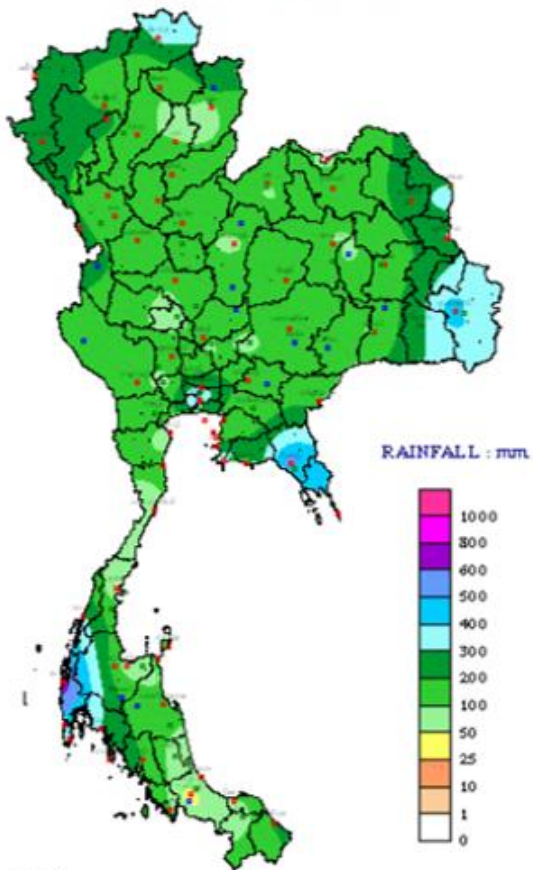
Water Resources

- More than land forms, water has conspicuously shaped the Thai culture. The Salween and the Mekong Rivers which largely define Thailand's land borders, originate in the broad region influenced by the frozen Himalayan reservoirs where ten of the world's great river systems originate within a radius of 200 kilometres.
- Cultural associations with water include; religious affiliations across this region, migration of Tai people along river valleys to what is now Thailand, and the development of food production systems which assume ready availability of water.

Water Resources (continued)

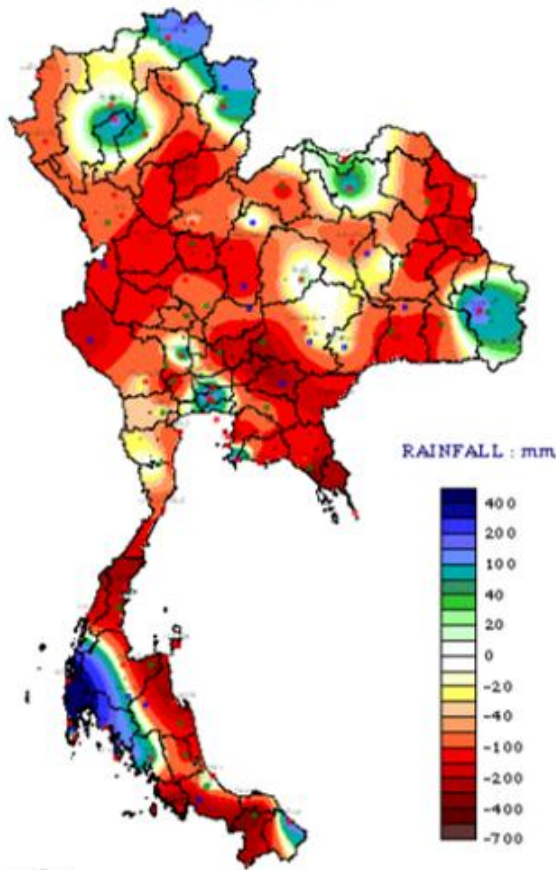
- The Chaophraya River, wholly within Thailand, is fed by the Ping, Wang, Yom and Nan Rivers which drain the northern highlands and the Pa Sak River which drains the Phetchabun mountains.
- Around 33 percent of the Kingdom is drained by this complex, the deposition of silt from which has extended the river mouth south into the Gulf of Thailand.
- Siltation has reduced the functionality of various cities across Thai history, from Lopburi to Ayutthaya to Bangkok, while providing extensive lands suited to agriculture with once surplus surface water resources (Table 1.3).

TOTAL MONTHLY RAINFALL
FROM 1-26 มิถุนายน 2016



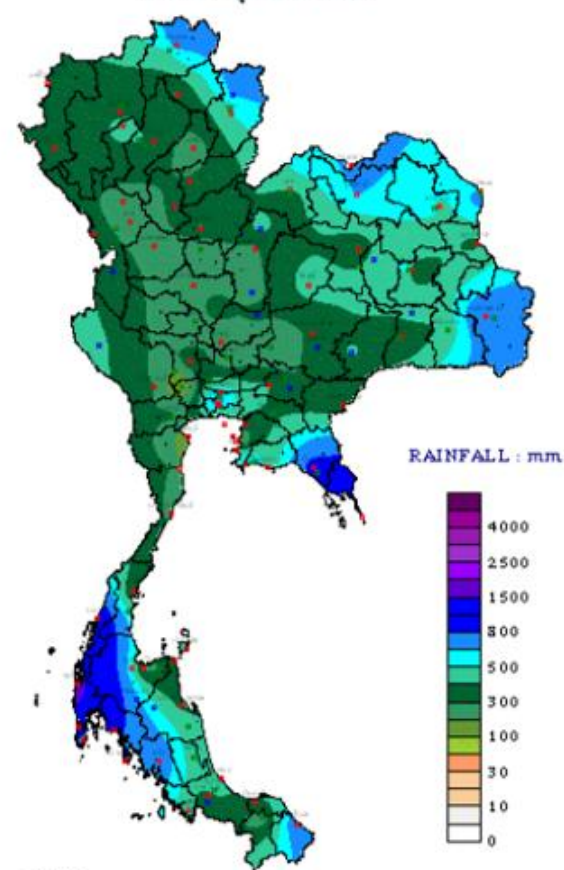
THAI METEOROLOGICAL DEPARTMENT

DEPARTURE FROM NORMAL
TO 26 มิถุนายน



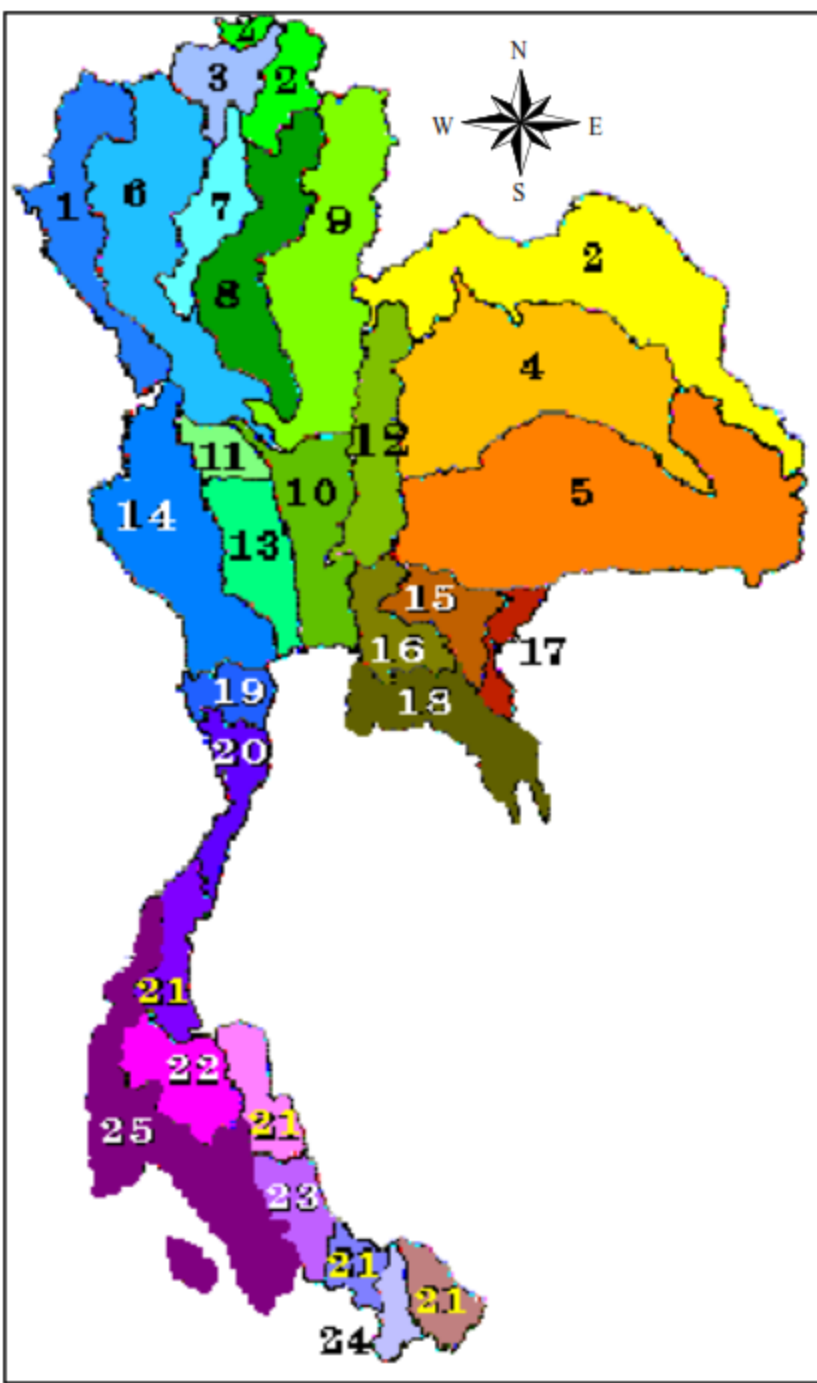
THAI METEOROLOGICAL DEPARTMENT

TOTAL RAINFALL FROM 1 JANUARY
TO 26 มิถุนายน 2016



THAI METEOROLOGICAL DEPARTMENT

Source: <http://www.interriskthai.co.th/wp-content/uploads/2017/12/map-july-1-2016.png>



Main River Basins of Thailand

1. Mae Nam Salawin
2. Mae Nam Khong
3. Mae Nam Kok
4. Mae Nam Chi
5. Mae Nam Mun
6. Mae Nam Ping
7. Mae Nam Wang
8. Mae Nam Yom
9. Mae Nam Nan
10. Mae Nam Chao Phraya
11. Mae Nam Sakae Krang
12. Mae Nam Pasak
13. Mae Nam Thachin
14. Mae Nam Mae Klong
15. Mae Nam Prachin Buri
16. Mae Nam Bang Pra Kong
17. Tonle Sap
18. East-Coast Gulf
19. Mae Nam Petchaburi
20. West Coast Gulf
21. Peninsula-East coast
22. Mae Nam Tapi
23. Thale sap Songkhla
24. Mae Nam Pattani
25. Peninsula-West coast

Purpose of water usage 20,566 MCM

Irrigated water
12,654 MCM
(62%)



Industrial water
242 MCM
(1%)



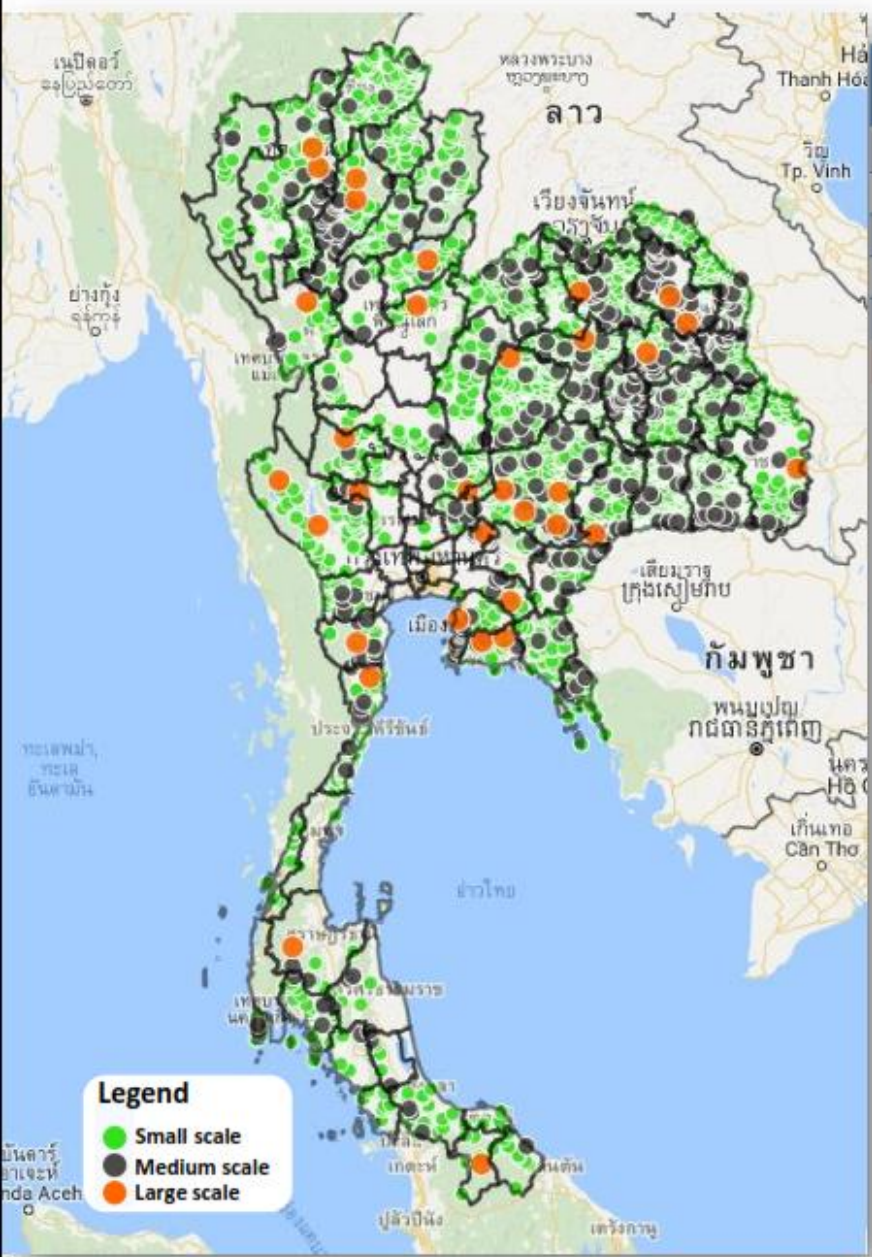
Ecology system
5,749 MCM
(28%)



Living (drinking) water
1,921 MCM
(9%)



Source: 2014 Annual Irrigation Project Report, Royal Irrigation Department



Project	Number of Project	Capacity (MCM)	Irrigable Area (M.ha)
Large scale	94	73,217	2.87
Medium Scale	671	4,219	1.05
Small Scale	13,842	1,790	0.18
Pumping station	2,557	1	0.72
Monkey cheek	223	451	0.01
Total	17,387	79,677	4.84



Source: 2014 Annual Irrigation Project Report, Royal Irrigation Department



Upstream - Store the water

Manage the water in reservoirs



Midstream - Retard the water

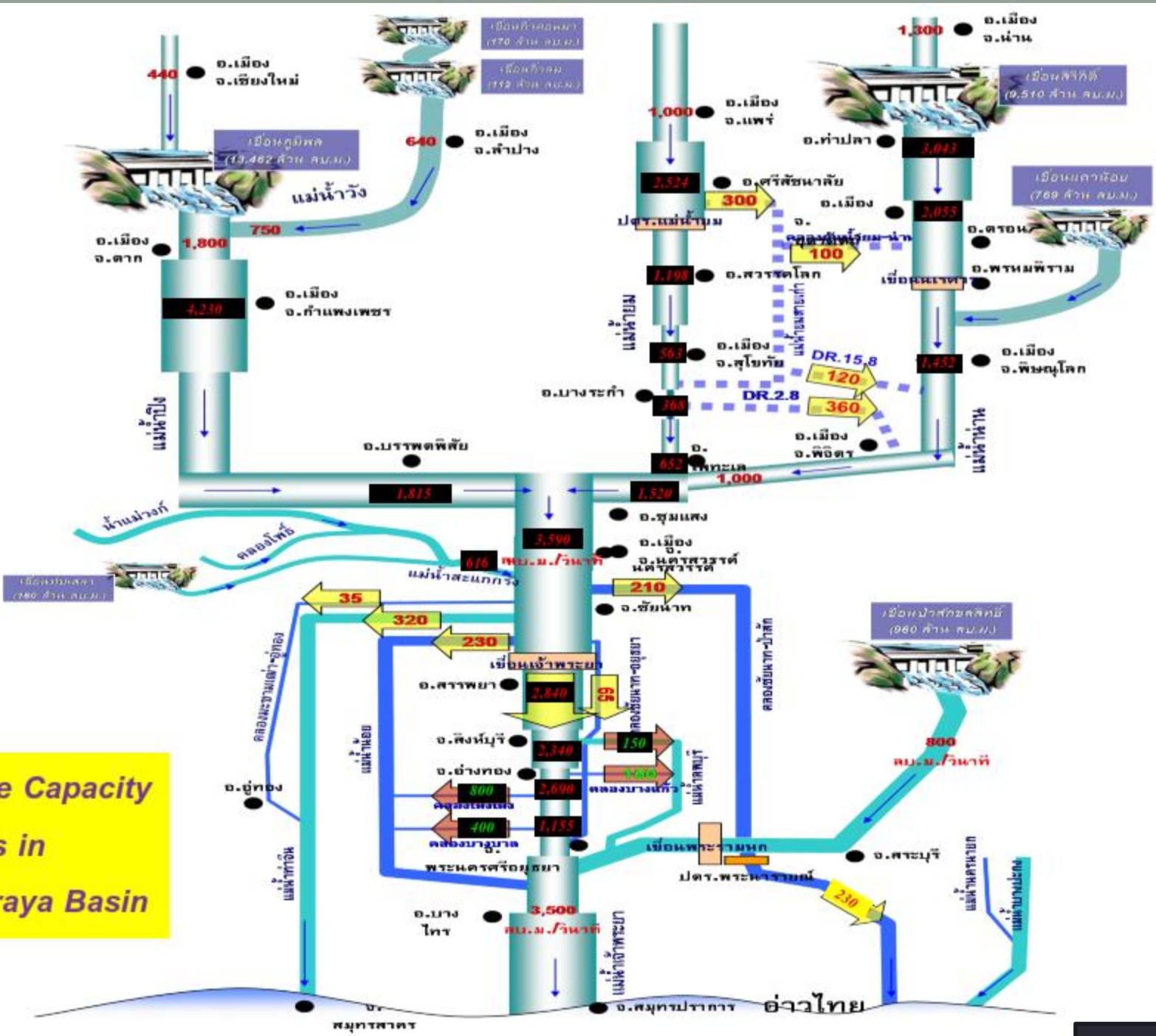
Manage the water in rivers and flood plains



Downstream - Speed up the drainage of water to the sea

Manage the water in downstream area

Source: 2014 Annual Irrigation Project Report, Royal Irrigation Department

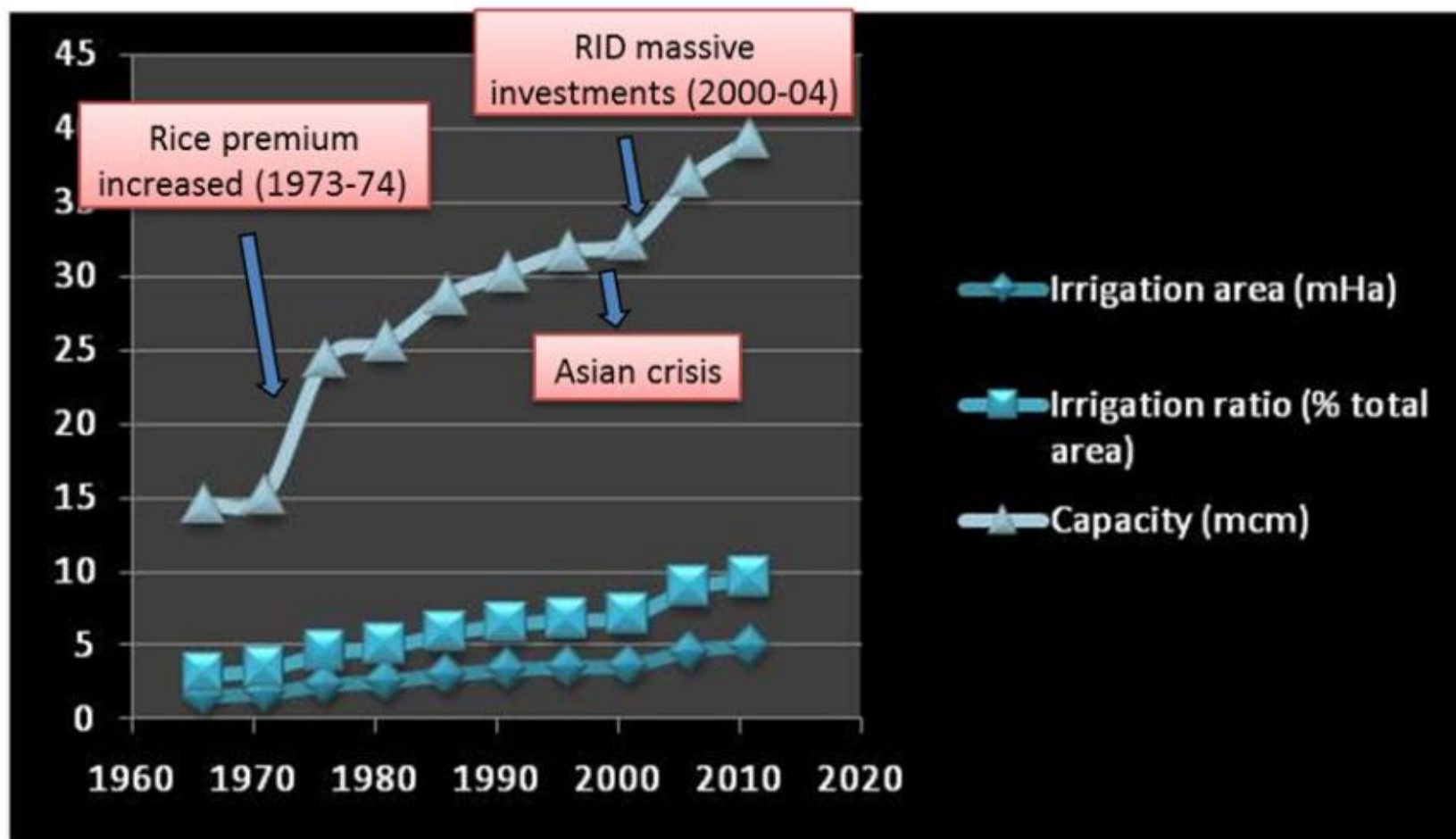


Province	Region	Area equipped for irrigation (ha)		
		total	with groundwater	with surface water
Bangkok	Bangkok	85 361	1 586	83 775
Ang Thong	Central	50 526	19 696	30 830
Chachoengsao	Central	115 380	1 178	114 202
Chainat	Central	115 841	31 443	84 398
Chanthaburi	Central	51 483	0	51 483
Chon Buri	Central	56 518	372	56 146
Kanchanaburi	Central	224 603	4 054	220 549
Lop Buri	Central	199 715	20 543	179 172
Nakhon Pathom	Central	88 999	6 349	82 651
Nakon Nayok	Central	36 433	2 317	34 116
Nonthaburi	Central	31 240	0	31 240
Pathum Thani	Central	78 250	6 415	71 836
Phetcha Buri	Central	75 783	12 299	63 483
Phranakhon Si Ayutthaya	Central	129 818	27 889	101 929
Prachin Buri	Central	63 050	7 717	55 333
Prachuap Khiri Khan	Central	68 794	2 945	65 850
Ratchaburi	Central	43 736	9 006	34 731
Rayong	Central	31 364	457	30 908
Sa Kaeo	Central	64 512	467	64 044
Samut Prakan	Central	51 452	0	51 452
Samut Sakhon	Central	38 024	0	38 024
Samut Songkhram	Central	3 586	245	3 341
Sara Buri	Central	75 399	10 777	64 621
Sing Buri	Central	46 574	18 790	27 784
Suphan Buri	Central	217 840	45 606	172 234
Trat	Central	24 516	127	24 389

Amnat Charoen	Northeastern	23 649	99	23 550
Buri Rum	Northeastern	71 382	52	71 330
Chaiyaphum	Northeastern	119 744	629	119 115
Kalasin	Northeastern	64 850	15 330	49 520
Khon Kaen	Northeastern	97 581	2 885	94 696
Loei	Northeastern	77 789	0	77 789
Maha Sarakham	Northeastern	46 736	4 677	42 059
Mukdahan	Northeastern	29 134	0	29 134
Nakhon Phanom	Northeastern	39 334	529	38 805
Nakhon Ratchasima	Northeastern	89 379	1 949	87 430
Nong Bua Lam Phu	Northeastern	37 433	528	36 905
Nong Khai	Northeastern	51 002	2 871	48 131
Roi Et	Northeastern	66 277	4 103	62 173
Sakon Nakhon	Northeastern	67 281	911	66 370
Sisaket	Northeastern	63 152	504	62 648
Surin	Northeastern	62 159	0	62 159
Ubon Ratchathani	Northeastern	110 036	2 121	107 915
Udon Thani	Northeastern	86 164	1 456	84 709
Yasothon	Northeastern	32 968	1 350	31 618
Chiang Mai	Northern	361 657	2 173	359 484
Chiang Rai	Northern	98 851	6 936	91 915
Kamphaeng Phet	Northern	166 265	21 864	144 401
Lampang	Northern	128 042	287	127 756
Lamphun	Northern	76 454	172	76 281
Mae Hong Son	Northern	27 387	2	27 386
Nakhon Sawan	Northern	149 611	38 332	111 279
Nan	Northern	152 407	63	152 344
Phayao	Northern	67 666	0	67 666
Phetchabun	Northern	156 241	1 114	155 127
Phichit	Northern	71 027	33 090	37 938
Phitsanulok	Northern	138 130	50 318	87 812

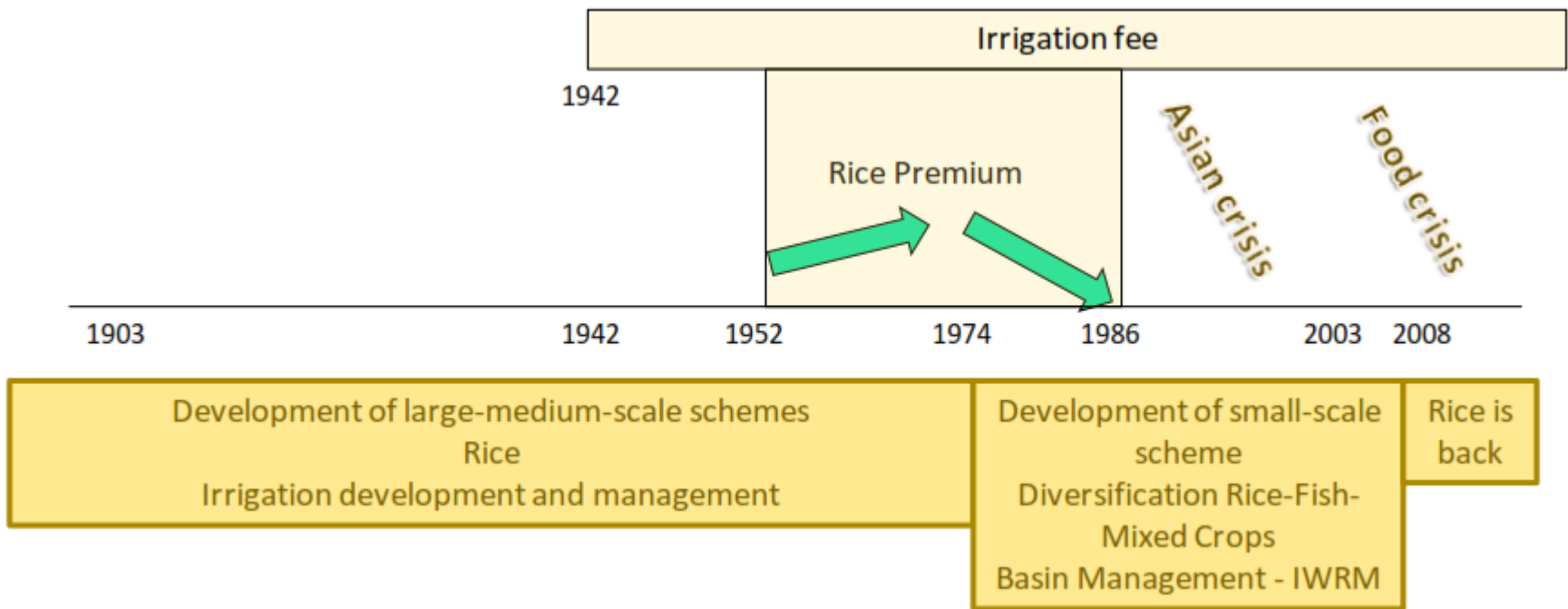
Phrae	Northern	106 379	237	106 142
Sukhothai	Northern	107 113	24 029	83 083
Tak	Northern	150 725	1 449	149 277
Uthai Thani	Northern	161 727	12 911	148 816
Uttaradit	Northern	96 301	7 797	88 504
Chumphon	Southern	69 387	0	69 387
Krabi	Southern	16 671	0	16 671
Nakhon Thammarat	Southern	386 630	7 495	379 135
Narathiwat	Southern	53 419	0	53 419
Pattani	Southern	23 457	910	22 547
Phangnga	Southern	14 767	0	14 767
Phatthalung	Southern	52 408	1 613	50 795
Phuket	Southern	2 117	0	2 117
Ranong	Southern	13 619	0	13 619
Satun	Southern	10 431	0	10 431
Songkhla	Southern	107 340	0	107 340
Surat Thani	Southern	72 150	0	72 150
Trang	Southern	19 216	0	19 216
Yala	Southern	52 439	0	52 439
Thailand total		6 414 880	481 063	5 933 817

Comparative evolutions of irrigation capacity, ratio and area in Thailand (1965-2011)



Source: Perret and Davidson (2015)

Chronological synopsis of a century of irrigation development and financing in Thailand



Source: Perret and Davidson (2015)

Water Resources (continued)

- In the twentieth century, the Chaophraya, and to a lesser extent the Kwaë Yai and the Kwaë Noi Rivers in the Mae Klong basin of the west and the Mun and Chi Rivers of the Northeast, have been viewed as irrigation, hydro-electricity and/or domestic and industrial consumption resources.
- The creation of dams on major rivers has significantly modified the environment, as has associated agricultural change.

Water Resources (continued)

Table 1.3 - Surface Water Resources of Thailand (million cubic metres)¹⁸

Region	River	Reservoir	Natural Storage	Rainfall volume
Northeast	26558	6231	193	236400
North	23175	48723	34	220500
East	29720	18781	156	76700
Central	3747	333	-	91000
South	6795	6708	53000	169700
Total	89995	80775	436	794300

Notwithstanding the significance of irrigation, rivers and underground water resources, the major water resource for agriculture continues to be rainfall.

Water Resources (continued)

- Underground water varies according to local hydrological conditions in the northern highlands.
- Alluvial and older terrace deposits yield viable and apparently sustainable sources of water, while the alluvium aquifers of the Central Plain and the Khorat aquifer of the Northeast yield salty water except from the upper aquifer which lies under highly populated areas.
- A 450 x 22 kilometre plain south of Nakhon Sri Thammarat in the South yields viable levels of water.
- The eastern provinces, even in the alluvial and terrace deposits, have the least groundwater potential of the Kingdom.

Climate

- Thailand's monsoonal climate is experienced as three seasons; a hot season from approximately March to May, a rainy season from approximately May to the end of October, and a sometimes less distinct cool season from approximately November through February.
- The two climatic classifications commonly applied to Thailand are; Tropical Rainforest, and Tropical Savanna. The rainy season is more protracted along the southeastern coast of Peninsula Thailand where average annual rainfall commonly exceeds 2,000 mm and reaches up to 4,000 mm in some areas.
- The majority of Thailand experiences average annual rainfalls between 1,100 and 1,500 mm, with the lowest rainfall commonly recorded in the Western Continental Highland rain shadow where average annual rainfall is less than 1,100 mm.
- Rainfall is influenced by monsoons, cyclones, and convection from all directions except the protected northwest.

Source: Directly quoted from Falvey (2000)

Climate (continued)

- Temperature variations between seasons are mainly small. Minimum cool season temperatures in January range from around 26C to 28C for most of the Kingdom.
- During the hot season, April temperatures range from 28C to 42C.
- Altitude reduces minimum temperatures in the highlands in the North and Northeast rarely to near 0C, while in southern Thailand variations are the lowest, between 26C and 30C all year.

Climate (continued)

- Weather variations in Thailand attract speculation, as elsewhere. Current knowledge can only suggest that these are a result of:
 - inter-annual variations in which climate varies between years and which is most commonly depicted to the public in terms of droughts, floods, and severe winters.
 - decade-scale climate variations such as recorded over eastern North America in 1958 and 1976.
 - long-term changes which may have 200 year or other cycles.
- Greenhouse gas effects remain difficult to detect among these natural variations.
- Anthropogenic environmental changes in Thailand are clearer in terms of forest and soil losses which affect native habitats as part of a continuous modification of the natural environment .

Other Natural Resources

- The flora, fauna, and people of the Kingdom form part of the natural resource base.
- The natural fauna is linked, to a large extent to the natural environment being preserved which, in this era relates predominantly to conservation or remaining forest resources.
- The wide ecological diversity of the Kingdom includes more than 170 endangered animal fauna species.
- Forests are less than 50 percent evergreen which includes tropical evergreen forest which is the most bio-diverse. Other evergreen forest types comprise typical evergreen, coniferous, and mangrove forests which are believed to provide habitat for some 40 endangered fauna species, 20 of which are found exclusively in such forests.

Source: Directly quoted from Falvey (2000)

Other Natural Resources (continued)

- Deciduous forests which occupy the drier, inland, and steep slopes include mixed deciduous and dry Dipterocarpus species, and particularly in the past, have included large teak (*Tectona grandis*) dominant forests.
- However, it is the resource of humans that has created a sophisticated agriculture, and which concerns this book.
- From a population within what is now Thailand of around four million in 1700, growing to some six million towards the end of the 1900's, today's almost 70 million has both been created by, and created a challenge for, Thai agriculture.
- Individual smallholdings necessitated by high rural populations allows for intensive cultivation and attention to crops which can, for example, maximise the effectiveness of chemicals used in agriculture.
- However, balanced against this are lower levels of education, higher levels of monetary poverty, and entrenched ideas about agriculture of both rural dwellers engaged in agriculture and the powerful urban elite.

Other Natural Resources (continued)

- For a society grounded in agriculture, each of art, culture, and tradition reflect associations with the soil.
- Just as a broad view of art is necessary to understand this axiom through, for example, considering more than temple art derived from an Indian city and jungle based religion, so a broad view of agriculture and the environment is necessary to understand the special characteristics of Thai agriculture.
- Thus an appreciation of Thai agriculture requires consideration of historical, political, scientific, social, environmental, and economic changes.

Regional Origins

- Thai agriculture originated in what is now China, which supported several distinct types of agriculture and appears to have the oldest of all agricultures as many literature suggested.
- The agriculture on the Tai people, who probably originated in what is now China, is but one of these.
- The rice agriculture of Thailand built on that of the Tai and borrowed from other neighbouring and indigenous forms of agriculture.
- While millet was an adaptable upland crop and a staple in early Asian civilisations, its production by shifting cultivation utilising a pointed planting stick did not allow development of large population concentrations.
- Rice usurped millet as the preferred cereal for dominant cultures by its adaptability to agriculture which produced cities and states across Asia, where eventually more than 90 percent of the world's rice would be produced.

Source: Directly quoted from Falvey (2000)

Regional Origins (continued)

- Rice seed could be broadcasted into wet areas and with minimal labour produce a viable crop.
- Over time, variations in yields were reduced by bunds which initially impeded natural drainage, and domesticated buffalo which puddled soil to reduce water infiltration.
- Buffalo were subsequently utilised in ploughing, and their supplementary benefit of fertilising the fields while performing work provides an early glimpse of the integrated nature of rice cultivation.
- By about the eighth century, a wet rice production system including fish and coconut production seemed to be preferred across all suitable areas of Southeast Asia, with taro, yam, sago, and vegetables maintained as mere standby reserves.

Regional Origins (continued)

- Control of water and land was essential to the development of this agriculture, aspects of which appear to emerge with the Tai ethnic group.
- However, such Tai innovations were not introduced into a technological vacuum; rather they blended with technologies of earlier regional powers, in particular the Mon-Khmer, and independent agriculturists.
- The latter may have retained elements of the prehistoric agriculture of Ban Chiang in the Northeast, where domestication of pigs, cattle, chickens, and rice may have occurred some 4000 years ago.
- The advance from a hunting and gathering economy to agriculture was the first step in intensification of food production; further intensification which became the hallmark of civilised societies, occurred from the Ayuthaya period.

Source: Directly quoted from Falvey (2000)

Intensification

- Agricultural intensification has usually been associated with large scale irrigation, low levels of labour productivity, and severe population pressure.
- However, in the case of early Thailand, the human population does not seem to have been sufficiently large to place any significant pressure on its fortuitously productive land and efficient farming systems.
- Even in recent times up to the 1960s, the majority of Thai farmers in irrigated areas elected to produce only one rice crop per year.
- Central Thailand populations during the Dvaravati and Lopburi periods, while high by contemporary regional standards, appear to have produced a surplus of food.
- This historical export capacity provides a clue to understanding Thai agriculture today.

Intensification (continued)

- A culture of adequacy of food production continues to pervade Thai decision making concerning agriculture and its development.
- The ability to expand agricultural production without a large decrease in the output per unit of labour, and a cultural attitude to share community tasks, has allowed Thai agriculture to largely escape a widespread association of agricultural labour with drudgery.
- It also ensured integration of the very persons who fed the nation with cultural activities. Off-season and part-time farmers of early Thai Kingdoms were valued craftsmen.
- Production of one's family needs for food could be a first priority with surplus to meet community, tax, religious or other obligations, or one's spare time could be allocated to cultural and other pursuits.

Source: Directly quoted from Falvey (2000)

Intensification (continued)

- These characteristic links between culture and agriculture remains evident in the role of food and its presentation within Thai culture, and possibly provides some understanding for slow acceptance of some labour and capital intensive agriculture.
- Even in, or perhaps resulting from, this agricultural Eden, the impacts of war, variable seasons, and periodic social decline have been evident through the centuries.
- The first publication in Thailand in a western language records drought, famine, green water, and poisoned fish in the early 1700s, which was the beginning of the agricultural export economy.

Intensification (continued)

Thailand has increased its food production through the usual means of:

- increasing the area of cultivated land
 - increasing the yield per hectare
 - increasing the number of crops per year
 - replacing lower yielding with higher yielding crops and varieties
 - reducing post harvest losses.
- Modern, as ancient, developments in Thai agriculture have been associated with irrigation.
 - Expected returns from rice have been used to justify large irrigation investments this century, and domestic rice prices have been manipulated to reflect these intentions, notwithstanding the influence of the less easily controlled export price.

Source: Directly quoted from Falvey (2000)

Intensification (continued)

- However, the early selection of superior sites for development of irrigation facilities may also be seen in terms of aristocrats gaining control of land which would benefit from slow implementation of an intricate and far reaching irrigation plan developed on behalf of King Chulalongkorn by van der Heide (1904).
- In retrospect, one could suggest that Thailand's irrigation has been implemented in a piecemeal fashion, often long after demand for the water was established, and as having been relegated a less important role than industrial and communication infrastructure.

Industrialisation

- Increased agricultural production resulting from population increase and irrigation provided surplus wealth for national economic development. Agriculture shrank in relative terms while growing and funding growth in other sectors.
- In 1960 and 1970 the sector of agriculture, forestry, hunting, and fishing engaged 82 percent and 97 percent of the active population respectively.
- Between 1970 and 1990, the growth of the agricultural sector was approximately four percent per annum compared with 8.5 percent and 7.3 percent for the industrial and service sectors respectively.
- The continued growth of the agricultural economy albeit at a slower rate than other sectors continues as an essential underpinning of the economy of agriculture, as is particularly evident in periods of large scale correction in the industrial and service sectors, such as during the 1990s.

Source: Directly quoted from Falvey (2000)

Industrialisation (continued)

- If social factors are ignored, agriculture's fall from the largest sector to only 14 percent of the 1981 economy in value added terms compared to manufacturing's rise to 22 percent, appears to indicate decreased reliance on agriculture.
- By 1993, the agricultural sector represented about one third of total exports by value, and more than 38 percent of land use within the Kingdom - 60 percent of which was paddy rice production, 23 percent field crops, and 9 percent fruit and perennial crops.
- The rising contribution of manufacturing industries was observed rather than caused by economic planners, incidentally leading to poor agricultural policies in the late 1970s and early 1980s.

Industrialisation (continued)

- Subsequently, maize export was liberalised in 1982, the centuries'-old rice export taxes were removed in 1986, and taxes on rubber were reduced, while cassava and sugar continued to be protected.
- Restrictive regulations for licensing, cross-province transport, and slaughterhouse ownership continued to stifle livestock development through this period.
- Liberalisation was interpreted as an emerging economic maturity and allowed more open communication in international trade and development.

Industrialisation (continued)

- Critically, the era of policy shifts away from agriculture towards industry were associated with rising agricultural impact on the environment.
- Thailand ranked ahead of Burma, Indonesia, the Philippines, Korea and Japan in terms of; increases in cultivated area, reductions in forest area, increases in agricultural production, increases the percentage of the labour force engaged in agriculture, and variability of agricultural production.
- Increases in irrigated area, in the use of tractors, and fertilisers were exceeded by some neighbours. Of particular interest, is the maintenance of paddy and cereal yields in Thailand compared to all of the other countries.

Industrialisation (continued)

- The potential for further production increases from Thai agriculture through water management, efficient fertiliser usage, and mechanisation have remained technologically achievable goals since that time.
- The difference between Thailand and its neighbours, and most countries of the world, remains its significant contribution to global food production from a less environmentally stressful form of agriculture.
- Notwithstanding an emphasis on industrialisation, agriculture contributed around 50 percent of Thai exports from 1980 through 1985, with the absolute value of these agricultural exports increasing from some 73 to 95 billion baht.

Industrialisation (continued)

- Major contributions from employment which reduced the cost of social services, and from export income which repaid foreign development debt, were not publicly reported as of special significance.
- Underestimation of such benefits from agriculture parallel the underestimation of benefits from forests in watershed management, habitat preservation, and general environmental improvement where social and natural resource economic analyses have yet to be applied.
- For a major agricultural country such as Thailand, consideration of the social and environmental benefits of agriculture is probably more important than it is to the majority of the world's countries engaged in such industrialisation comparisons.

National and Global Responsibilities

- Modern agriculture is the main form of terrestrial natural resource management, meeting rising food demands as it impacts on the environment in a manner which we only beginning understand.
- Historically, an essential foundation of civilisation, the world's six billion people could not today survive without productive agriculture.
- Humans could move from an exhausted to a new site until recently, as our behaviour continues to reflect.
- Now agricultural technologies are increasingly assessed against their ability to continually produce the required output while maintaining the underpinning natural resource base.
- Practically, this is interpreted as optimising production and its sustainability within the controlled agricultural environment, as distinct from the original natural environment which has largely disappeared.
- Unfortunately food production to meet global demands, or even Thailand's current debt and lifestyle demands, is not yet possible from low input systems alone; nevertheless, co-existing self-sufficient and commercial agricultural systems may be the best future approach for Thailand.

Source: Directly quoted from Falvey (2000)

National and Global Responsibilities (continued)

- World population shows an exponential rise, which should decline as birth rates fall with rising levels of health and affluence.
- However, under the best scenario, population continues to rise through most of our lifetimes.
- The Green Revolution of the late 1960s and early 1970s enabled Asia in particular, to feed itself, new varieties of rice with doubled yields to cover 33 percent of rice areas, and maize yields to quadruple.
- Feeding that global population of 3.7 billion, twice that of fifty years earlier, was thus accomplished.

National and Global Responsibilities (continued)

- By 1990, 1.5 billion more people being fed, and economic progress was evident, particularly in Southeast and East Asia.
- Such rising affluence increased demand for food per person and of special foods often produced with lower resource-use efficiencies.
- Total food production requirements therefore rose further, causing greater environmental pressures in a country such as Thailand which relies on food exports for national wealth.
- With such environmental pressure, and the frequent prospect of famine in many nations of Africa and Asia, Thailand faces the dilemma of feeding fellow human beings as a good global citizen while preserving its underlying resource base.

Major exporters

	Rice	Cassava	Sugar cane	Rubber	Palm Oil
Top 5 exporters	1.Thailand 2.Vietnam 3.India 4.Pakistan	1.Thailand 2.Vietnam 3.China 4.Indonesia 5.Brazil	1.Brazil 2.Thailand 3.Australia 4.EU 5.Guatemala	1. Thailand 2. Indonesia 3. Malaysia 4. Vietnam 5.Cambodia	1.Indonesia 2. Malaysia 3. Thailand 4. Papua New Guinea 5. Jordan
World market share of top-5 exporters	74.75%	86.23%	67.32%	80%	94.94 %

Source: Office of Agriculture Economics (2008)

Major importers

	Rice	Cassava	Sugar cane	Rubber	Palm Oil
Top 5 importers	<ol style="list-style-type: none"> 1. Philippines 2. Iran 3. Nigeria 4. Saudi Arabia 5. EU 	<ol style="list-style-type: none"> 1. EU 2. China 	<ol style="list-style-type: none"> 1. EU 2. Russia 3. US 4. Indonesia 5. India 	<ol style="list-style-type: none"> 1. China 2. EU 3. US 4. Japan 5. India 	<ol style="list-style-type: none"> 1. China 2. India 3. EU 4. Pakistan 5. Bangladesh
สัดส่วนผู้นำเข้า หลัก 5 ประเทศ แรก ต่อ ปริมาณ การค้าของโลก	26.58%	80%	26.34%	70%	58.68 %

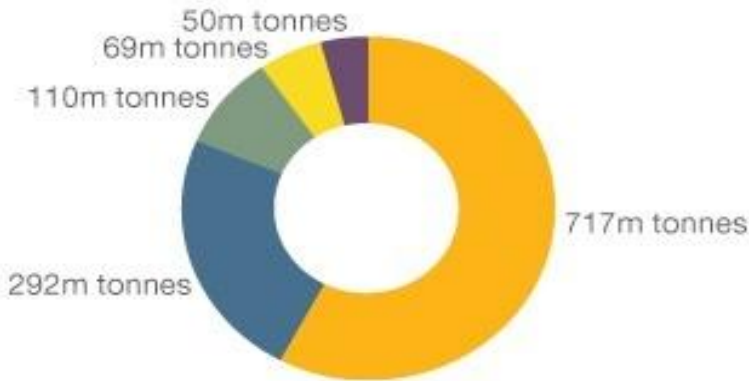
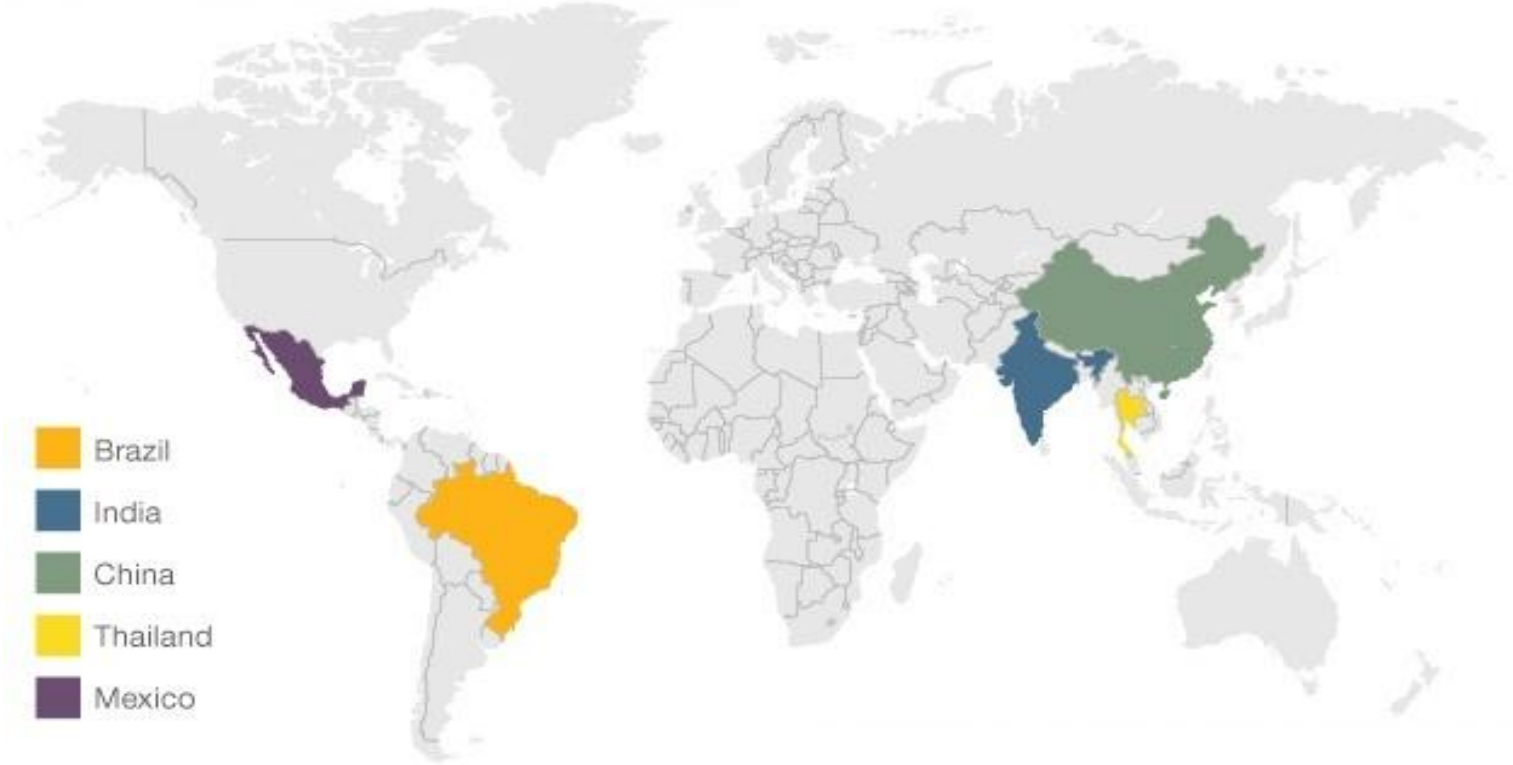
Source: Office of Agriculture Economics (2008)

Thin markets of agricultural products

	Rice	Cassava	Sugar cane	Rubber	Palm Oil
Traded volume/Global production	4.37%	2.78%	32.44%	31.51%	73.11 %

Source: Office of Agriculture Economics (2008)

The world's top producers: Sugar Cane



Source: <http://zernoexport.com/en/sahar>



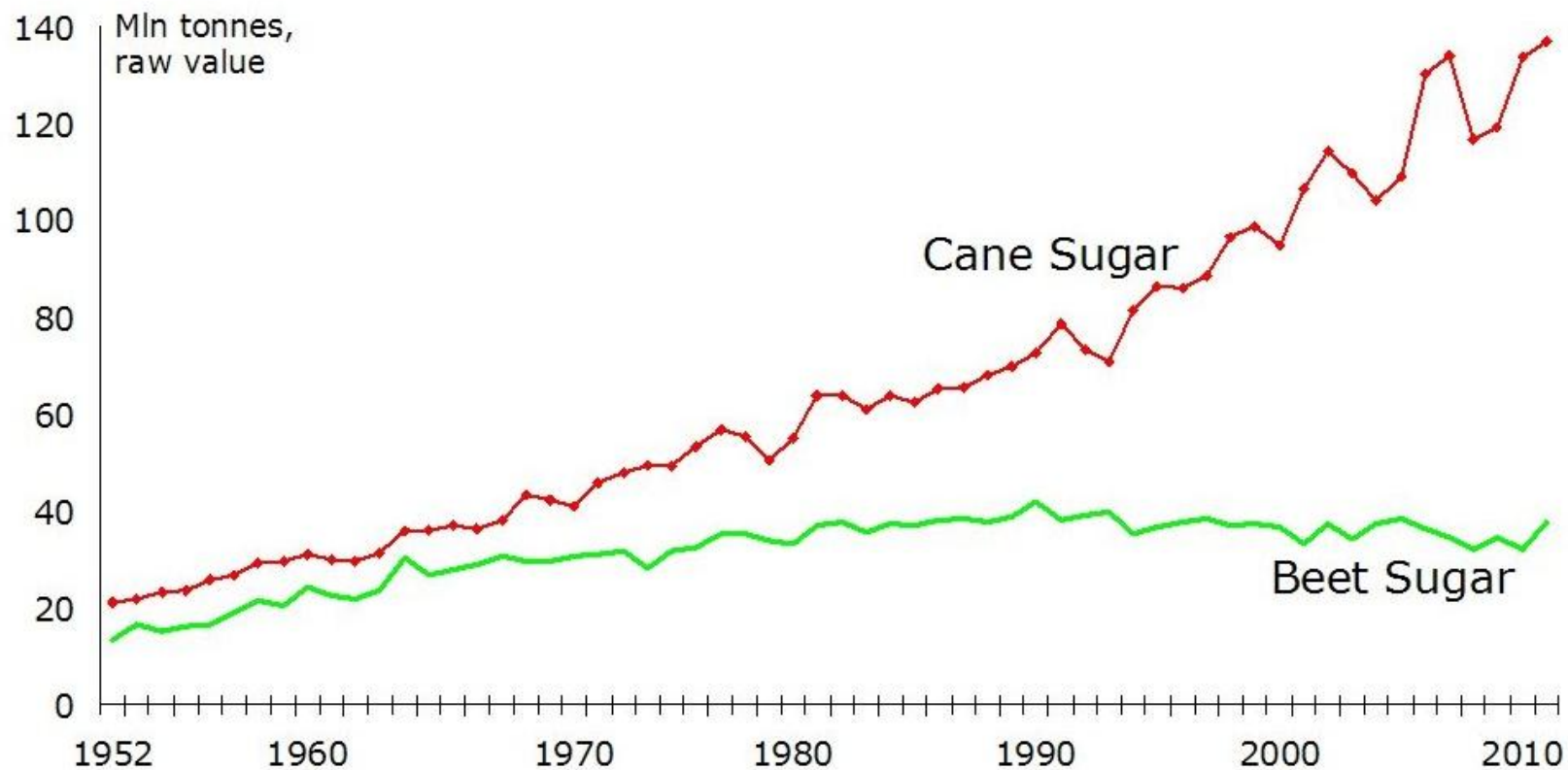
Sugar cane

Sugar beet



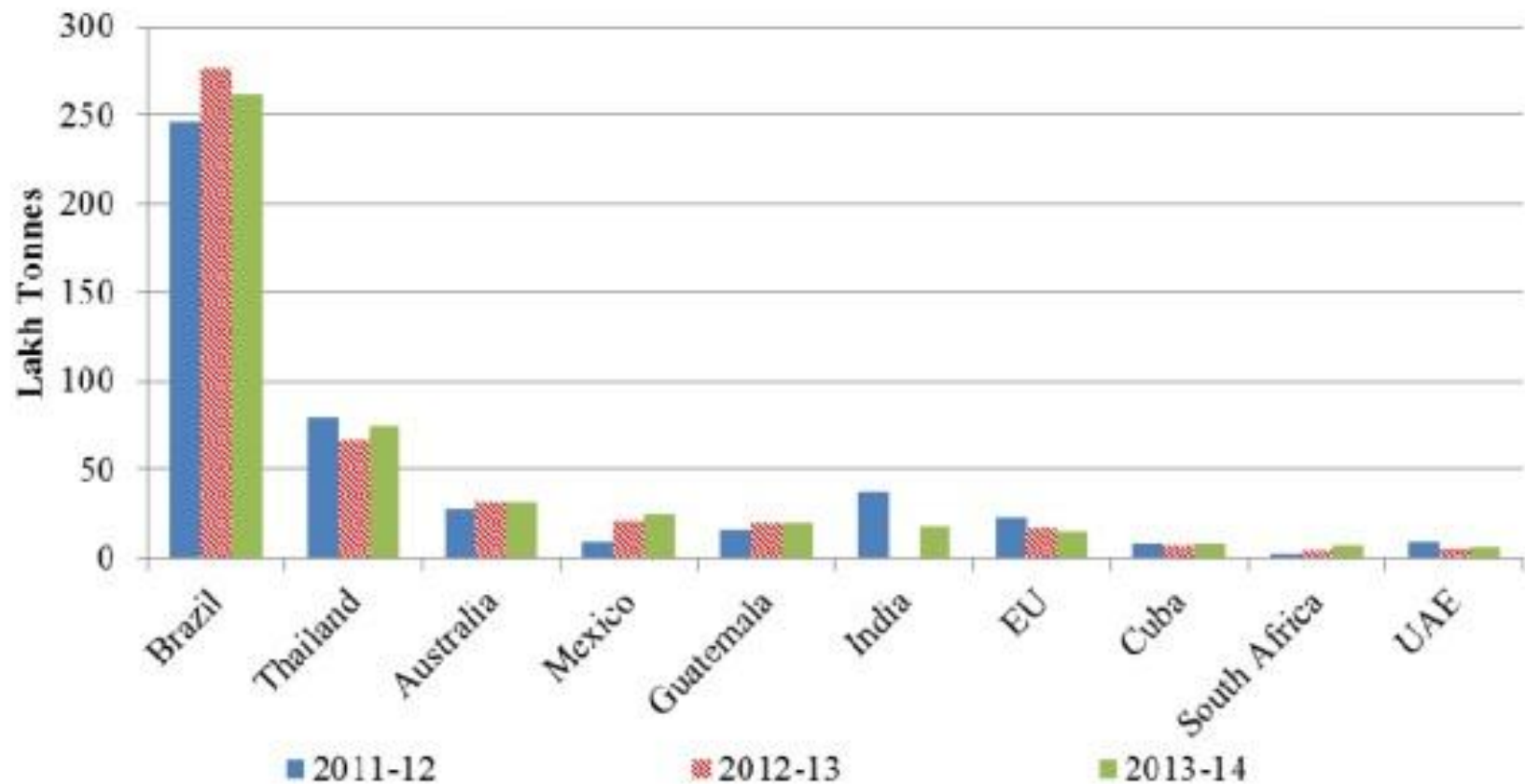
Source: <http://zernoexport.com/en/sahar>

World beet and cane sugar production 1952/53-2011/2012



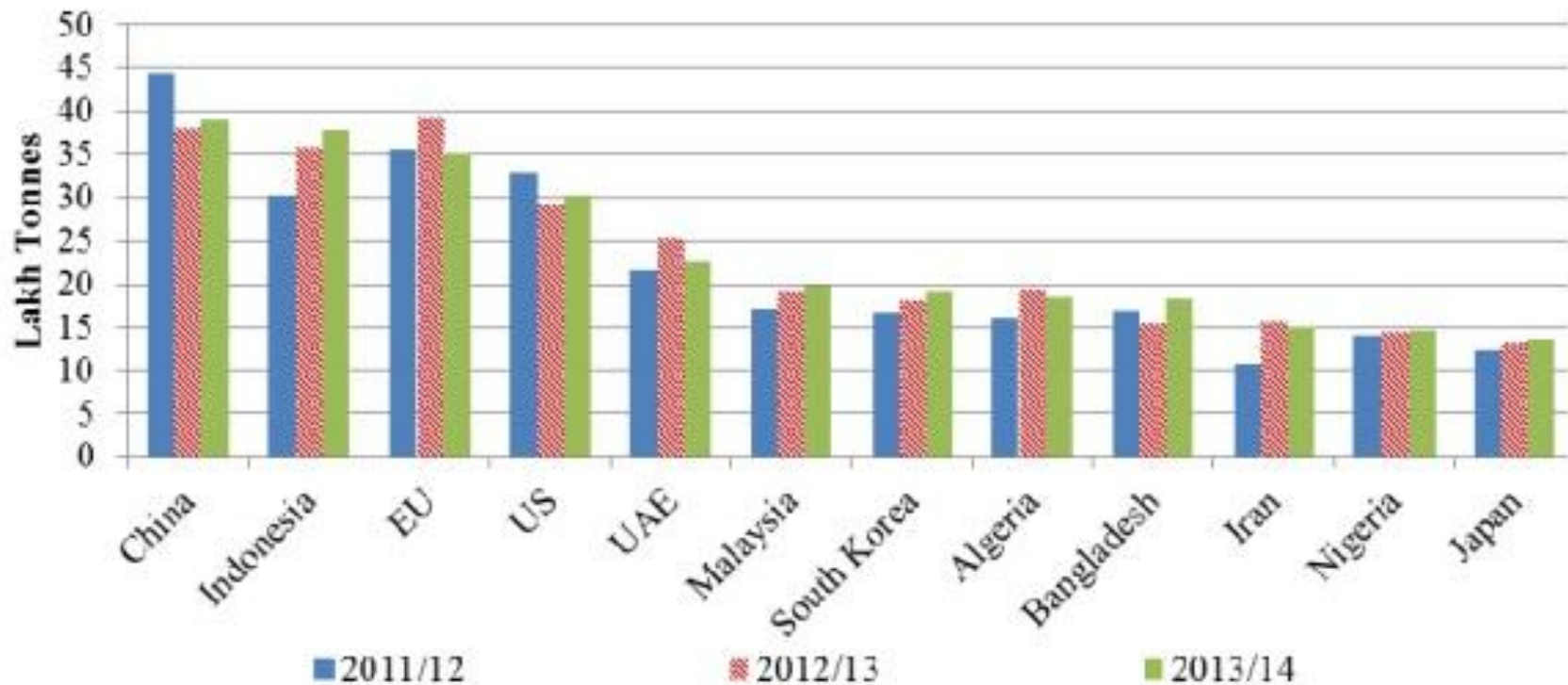
Source: <http://zernoexport.com/en/sahar>

Major sugar exporting countries



Source: <http://zernoexport.com/en/sahar>

Major importing countries



Source: <http://zernoexport.com/en/sahar>

National and Global Responsibilities (continued)

- Modern agriculture has preserved the maximum possible space for nature and wildlife through its high efficiency of production on productive land
- The areas of land saved by the introduction of modern cereal varieties to China calculated from expected yield increases without modern varieties compared to actual use indicate wide-scale protection of sensitive land.
- In this way, agricultural research form part of natural resource management research; it also highlights the anachronistic position of Thailand in effectively subsidising food importing countries though low agricultural prices and uncosted environmental impacts.

National and Global Responsibilities (continued)

Thailand is faced with the options of:

- continuing to subsidise the development of other nations for minimal benefit
- reducing exports, and hence income, where environmental conflicts are clear
- rationalising investments;
 - in research to ensure responsible agricultural practise,
 - in education to ensure a widespread ability to apply improved technologies,
 - in industry to build on national strengths in agriculture.

National and Global Responsibilities (continued)

- As an efficient major agricultural exporter in a price environment that neither reflects social or environmental costs of production, Thailand assists the world to meet higher ends. Global responsibilities must balance management of the natural resource environment.
- In the case of Thailand, a rising association of agricultural production with poverty suggests disenfranchisement of the many in the population who have contribute to the national well-being and global demands.

Current Situation

- From a land fortunate in its natural resources, and the infusion of rice into the culture of the peoples who have created Thailand, sustaining the resource base for agriculture is a new challenge.
- Modern Thai agriculture embodies new technologies which have built on traditional technologies developed over its 5,000 year rice farming history.
- Historical governance approaches were beginning to show their weaknesses in a new economic system.
- Thailand has met economic demands from export income which traditionally relied on expansion of the agricultural area and moderate intensification.

Current Situation (continued)

- Modern mechanisation and chemical pesticides and fertilisers in association with large scale irrigation facilities have allowed regularity of agricultural production for export.
- Other simultaneous changes in Thai society have created apparent labour shortages and oriented agriculture to a global system.
- The current agricultural situation derives particularly from such developments of the past three decades.

Current Situation (continued)

Five characteristics of arising from developments of the past 30 years, are:

- (1) An orientation to export markets with domestic prices in the main being strongly influenced by international prices - some 77 percent of the value-added in crop agriculture arises in the production of traded goods.
- (2) Expansion of the crop sector in the past has been mainly based on conversion of forest land to cultivated area - availability of such new land is extremely limited and hence increases in production must arise from increases in yield.
- (3) Rice, once the epitome of Thai agriculture, has been progressively replaced by field crops including maize, kenaf, cassava, and sugar cane - from 1961 to 1985, the area cultivated for field crops expanded 3.3 percent per annum compared with 1.8 percent for rice.

Current Situation (continued)

(4) Governmental involvement in the agricultural sector includes regulation of foreign trade, taxation, exchange rates, and trade restrictions, and also public resources for infrastructure and support services for agriculture.

(5) Institutional changes, such as the emergence of large food processing agribusiness, have affected farming systems, for example in the pineapple, tobacco, and some livestock and vegetable industries - tractor costs have reduced through the development of secondary industry, biotechnology has accelerated the production of new crop varieties, and usage of fertiliser, pesticides and herbicides has increased significantly.

Current Situation (continued)

- Having largely achieved the 1930s' political objective of stability and global respect, at least partly through following the common approach of natural resource exploitation, Thailand has reached a barrier.
- Apparently locked into the need for high levels of agricultural exports to repay international debts of other sectors, a higher intensity of production using Green Revolution technologies seems inevitable.

Current Situation (continued)

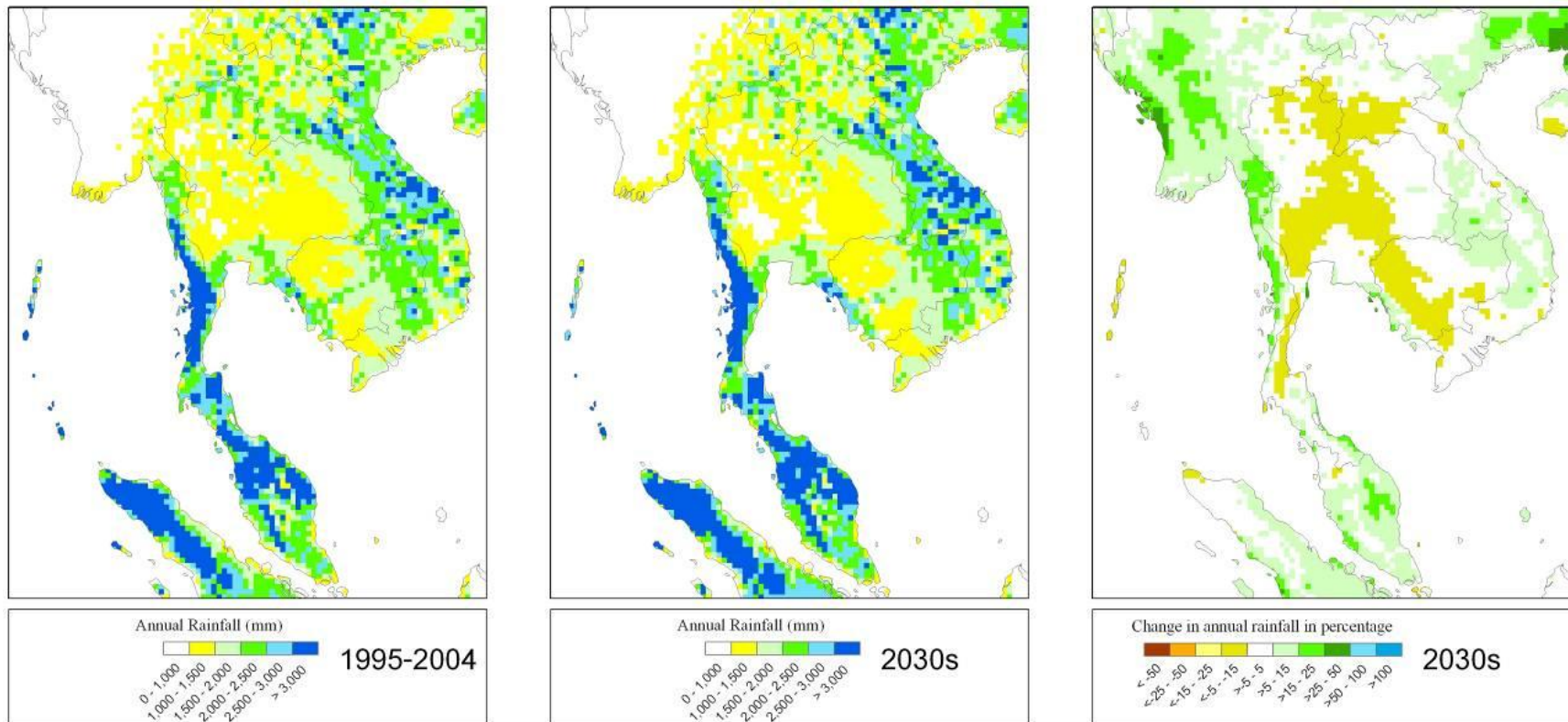
- One benefit of the late adopter in this case is the luxury of learning from the experience of other countries. It is therefore critical that appropriate legislation and action following attitudinal changes reflect a commitment to, and knowledge of, environmental management.
- Shifts in policy may already be reflected in such mechanisms as the unique nationwide ban on logging and rising agreement that land and water are no longer free or abundant resources.

Index	Thailand	Japan	Remarks
1 Land area (1,000 km ²)	514	378	1.4 times of Japan
2 Population (Million)	66	128	52% of Japan
3 GDP (billion USD)	395	4,902	8% of Japan
4 GDP per capita (USD)	5,878	38,491	15% of Japan
5 Paddy/Rice field (Million ha)	10	2	5 times of Japan
6 Paddy/Rice Production (Million ton)	29	11	3.7 times of Japan
7 Paddy/Rice Yield (1,000kg/ha)	3	4	0.7 times of Japan
8 Employment in agriculture (% of total employment)	40	2	



Source: https://www.yanmar.com/en_th/technology/technical_review/2017/1005_3.html

Projected future pattern of rainfalls



Source: Southeast Asia START Regional Center

Current Situation (continued)

- Total land availability in 1985 was assessed at some 321 million rai (51.4 million ha) of which 136 million (21.8 million ha) was designated as national forest reserves, 93 million rai (14.9 million ha) of which remained intact.
- Some 26 million rai (4.2 million ha) had been abandoned or was used only for grazing, and the cultivated area represented some 152 million rai (24.3 million ha) planted to rice, (84 million rai) upland crops (52 million rai), and perennial crops (70 million rai).
- In addition to the limitations on land, the 1994 drought refocussed attention on earlier advice that harvested water was declining in quantum while demands from agricultural, and in particular urban and industrial use, were increasing.

Current Situation (continued)

At the same time, FAO reported that crop yields due to such factors as:

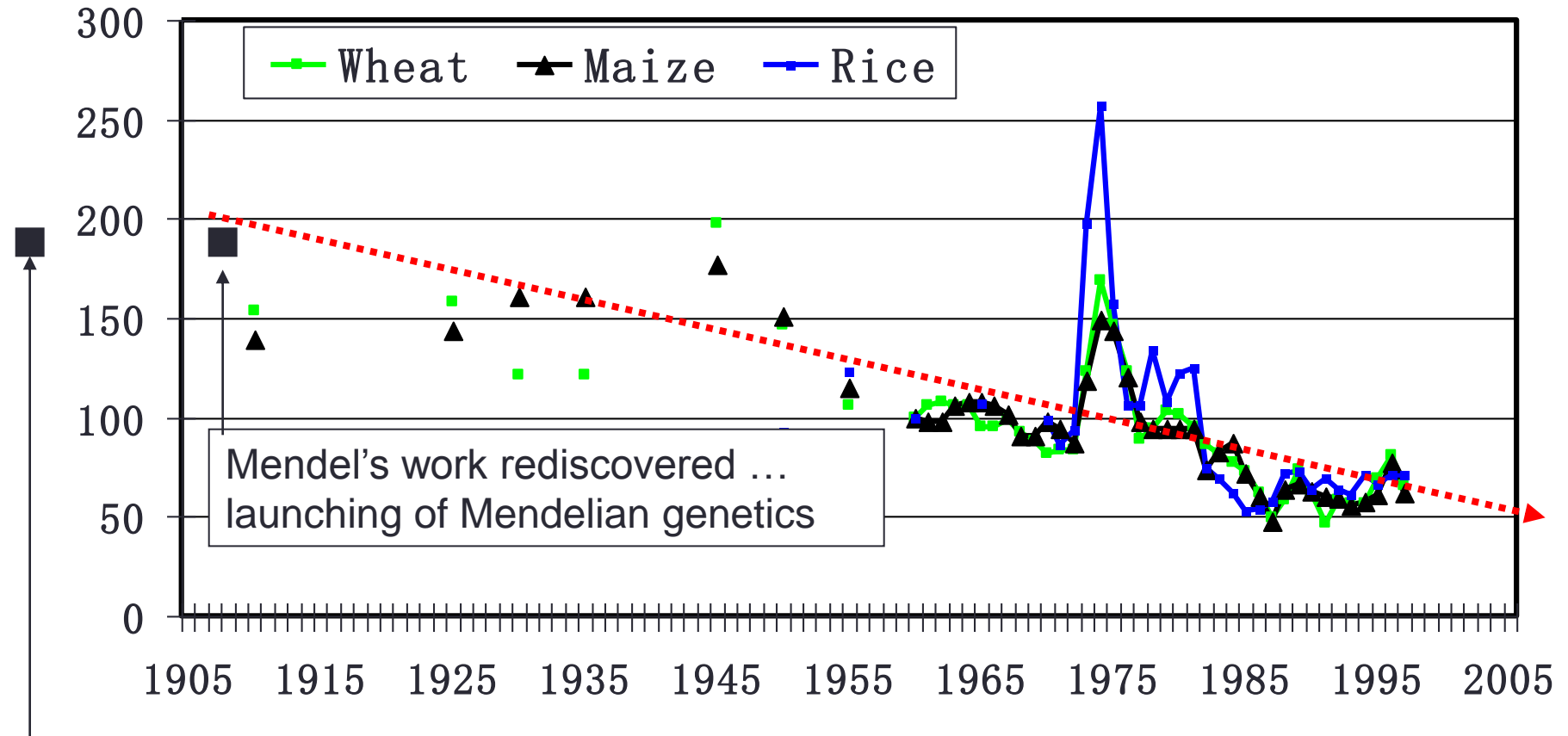
- physical, chemical and biological deterioration
- cultivation on steep sloping land without soil conservation practices
- inappropriate farming systems for increasingly intensive agriculture
- poorly defined land ownership with associated restrictions of access to fair credit
- a poorly developed farm credit sector
- poorly developed agricultural infrastructure
- irregular rainy seasons

Current Situation (continued)

- Government leadership is paramount in such a country, yet its influence on agricultural practices is limited to incentives which must compete with those of market prices.
- Apparent influence through water allocation in the central Chaophraya system is constrained by political pressure, and policy initiatives directed via field extension officers are typically of short term impact, due to officers' competing responsibilities and frequent changes in policy.
- Now globally oriented, Thai agriculture requires a global, policy perspective in more than fiscal terms; agriculturally-linked poverty requires enlightened social policy, and international political influence depends on sound environmental practice.

The Genetic Revolution has lowered the real global cereal price index

Real cereal price index
(All prices = 100 in 1960)



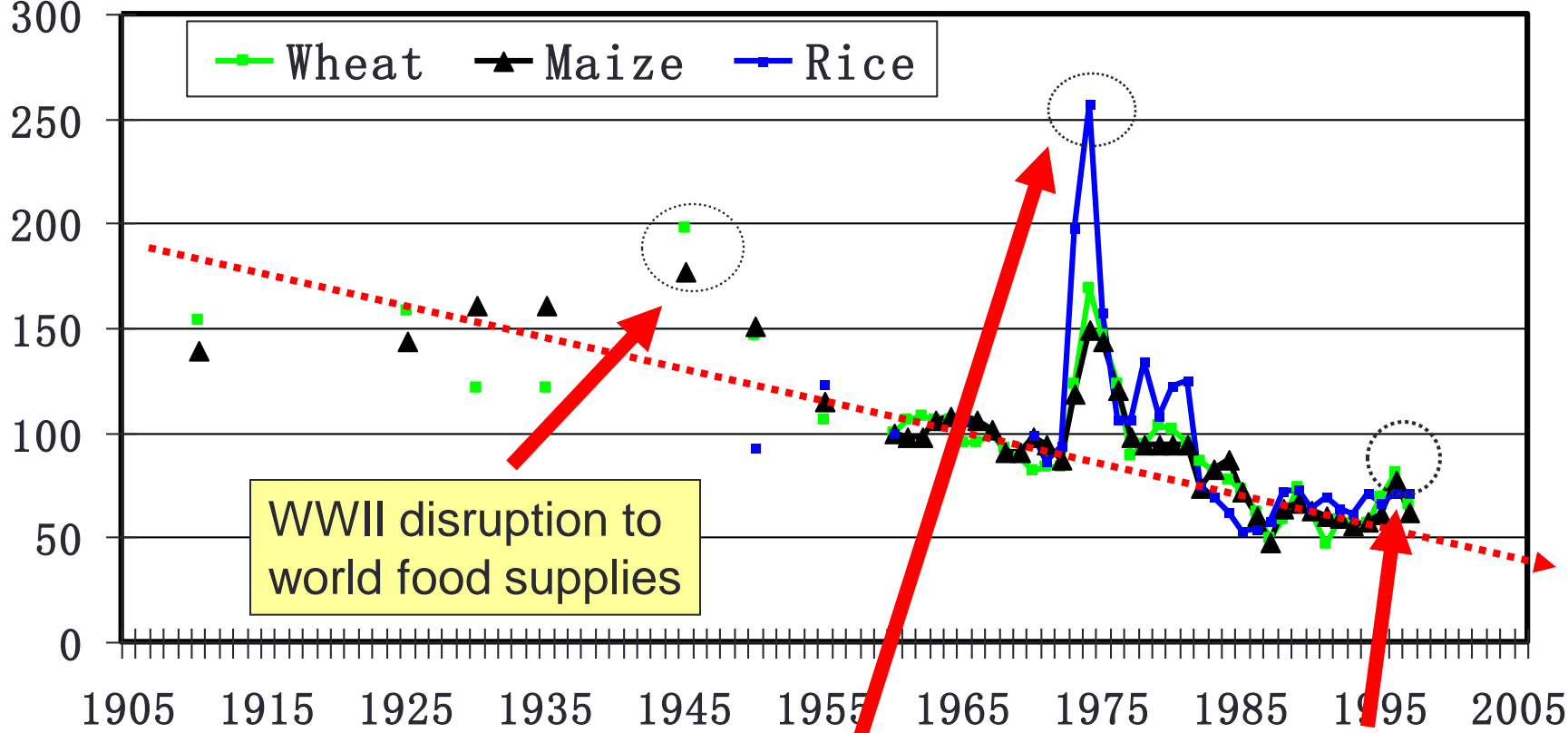
≈ Real price of food when Gregor Mendel published his paper: "Experiments in Plant Hybridization" [1866]

Source: IFPRI

Supply shortage caused “price spikes” in the past

All previous spikes preceded by major global supply shock (in a number of major exporting countries)

Real cereal price index
(All prices = 100 in 1960)



Worst US drought since the 1930s

Midwest/Canadian drought + failure of Brazil soybean crop

Source: IFPRI

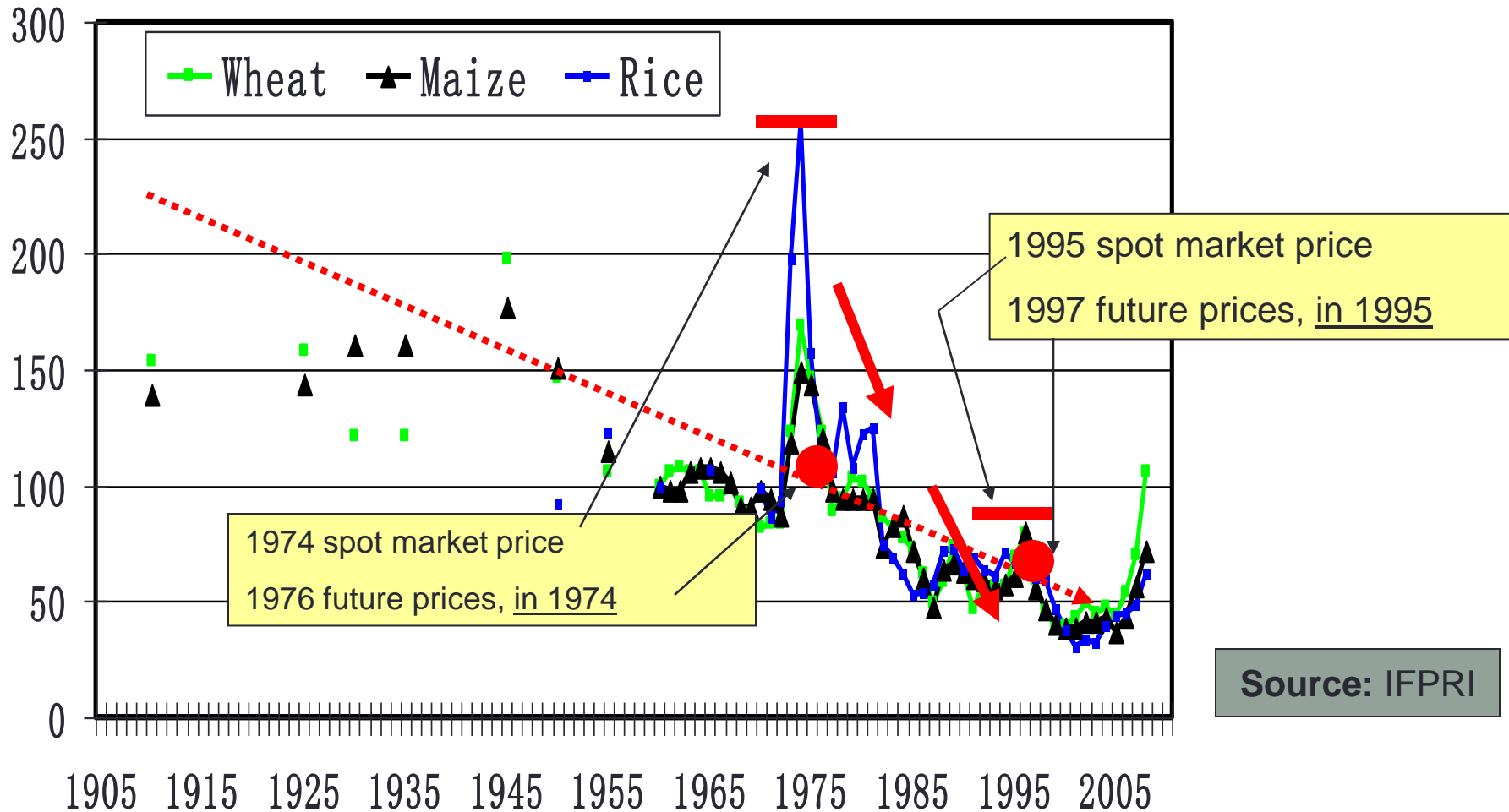
New evidence of global price relations

- Despite expected rises of grain and soybean productions in 2008, the prices in commodity future market for 2009-2010 are as high (or higher) as their current prices
- Markets are clearly expecting prices to stay high ... clearly: this is not a supply shock-led rise

Source: IFPRI

Relationship between spot and futures prices during previous “world food crises”

Real cereal price index
(All prices = 100 in 1960)

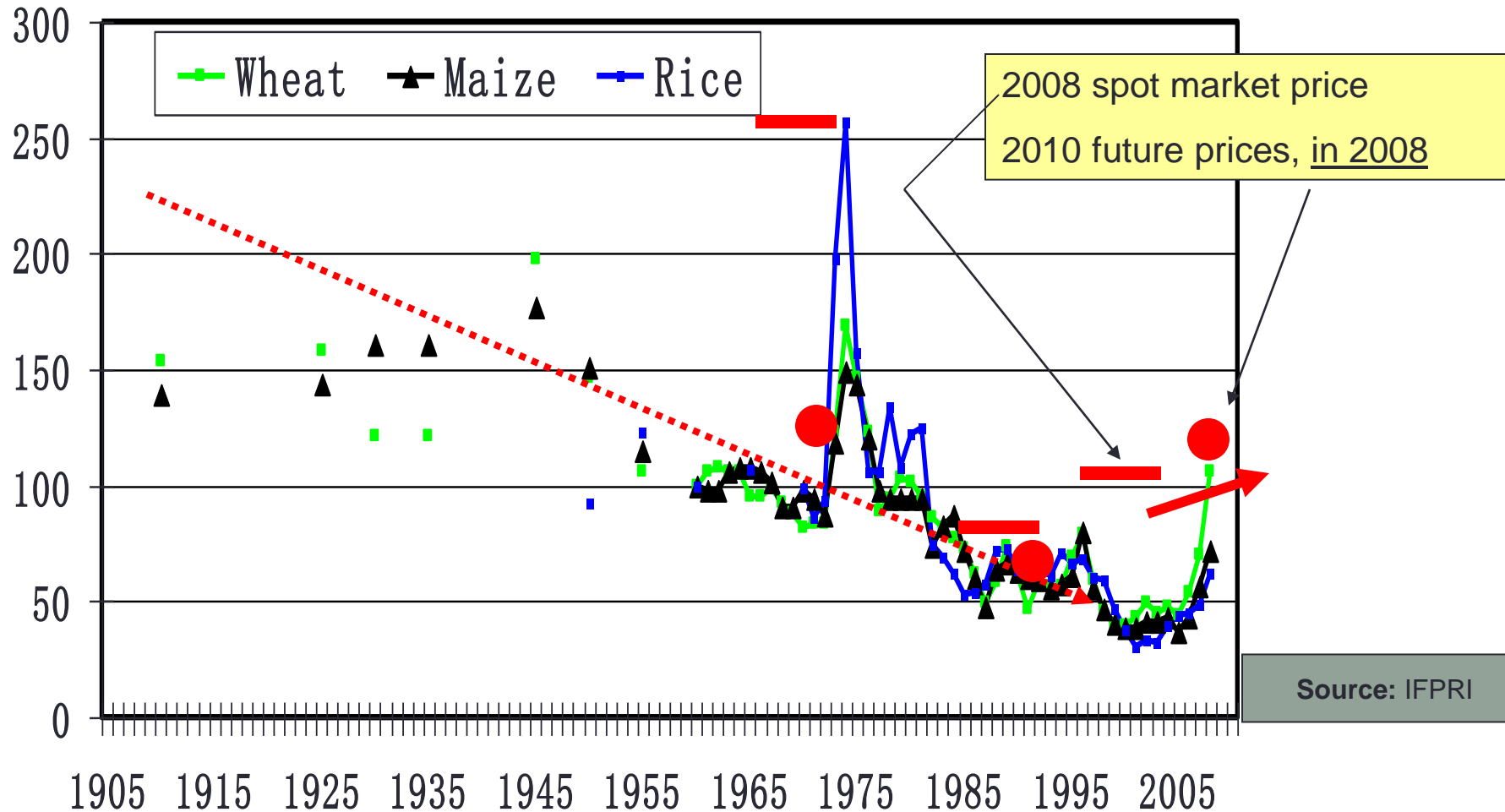


Source: IFPRI

Relationship between spot and futures prices during “world food crises”

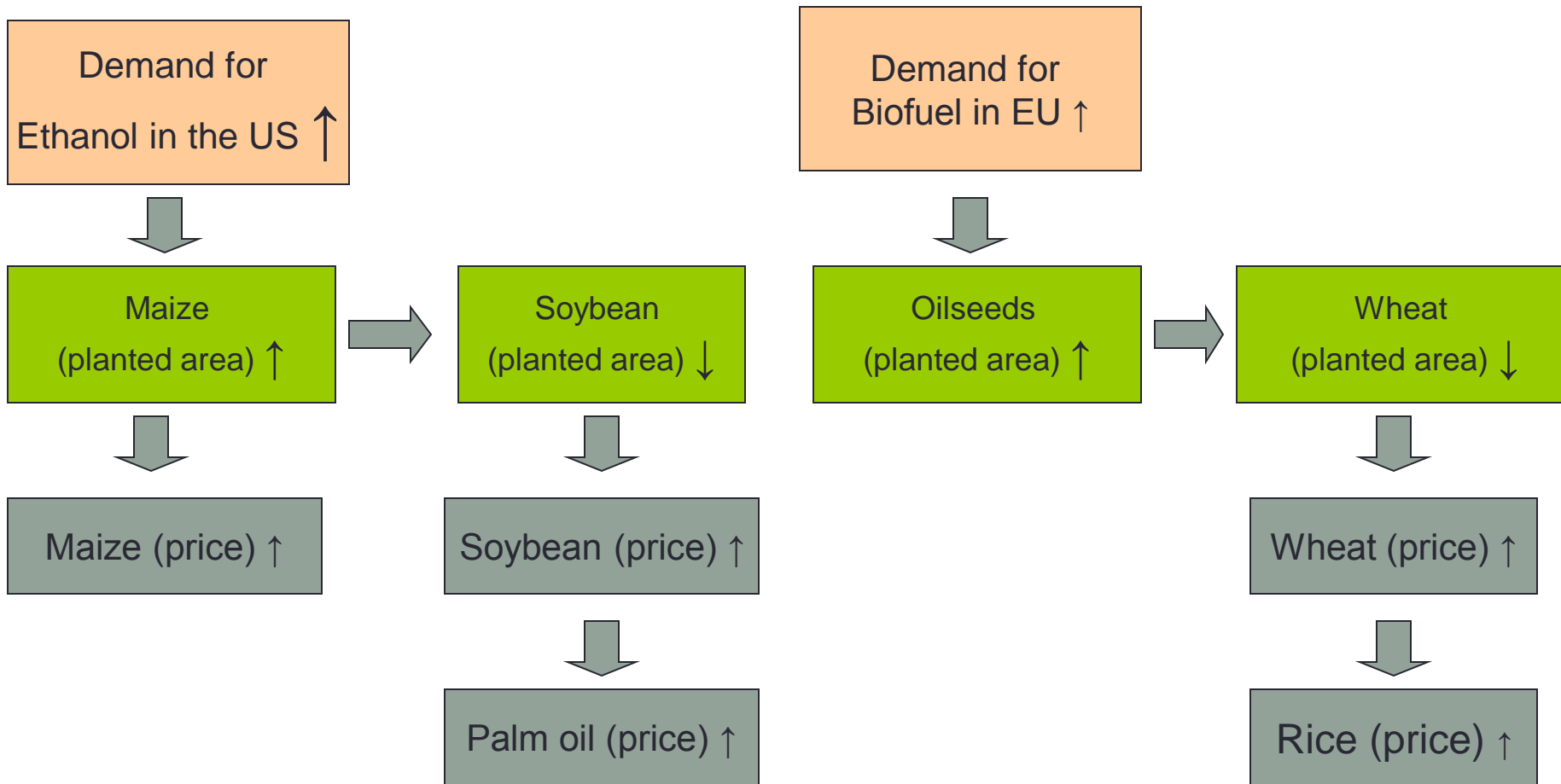
This means markets do NOT expect prices to come back down to trend ... obviously this time the price rise is not due (only) to a supply shock

Real cereal price index
(All prices = 100 in 1960)



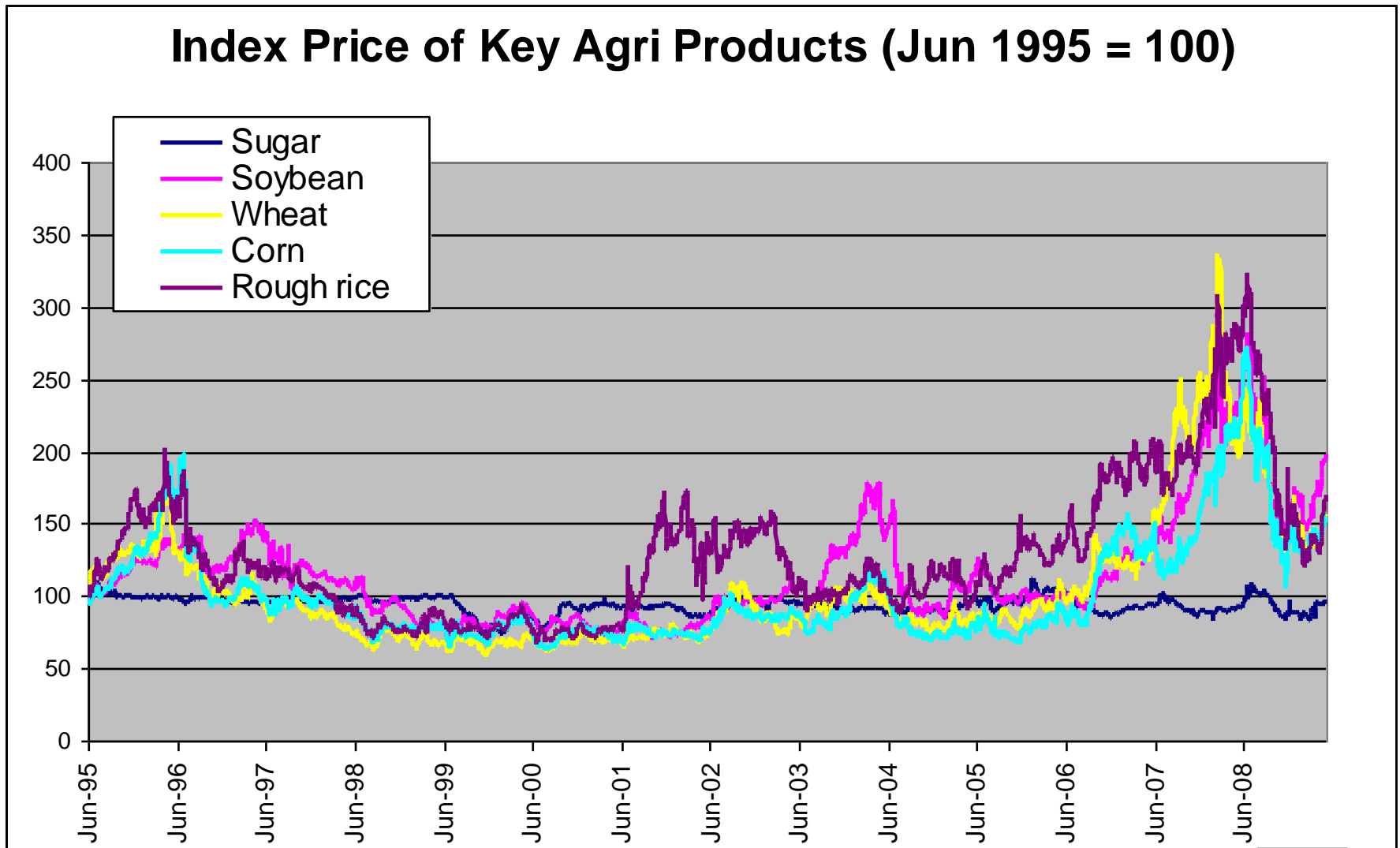
Source: IFPRI

Linkage of prices in the world agricultural markets



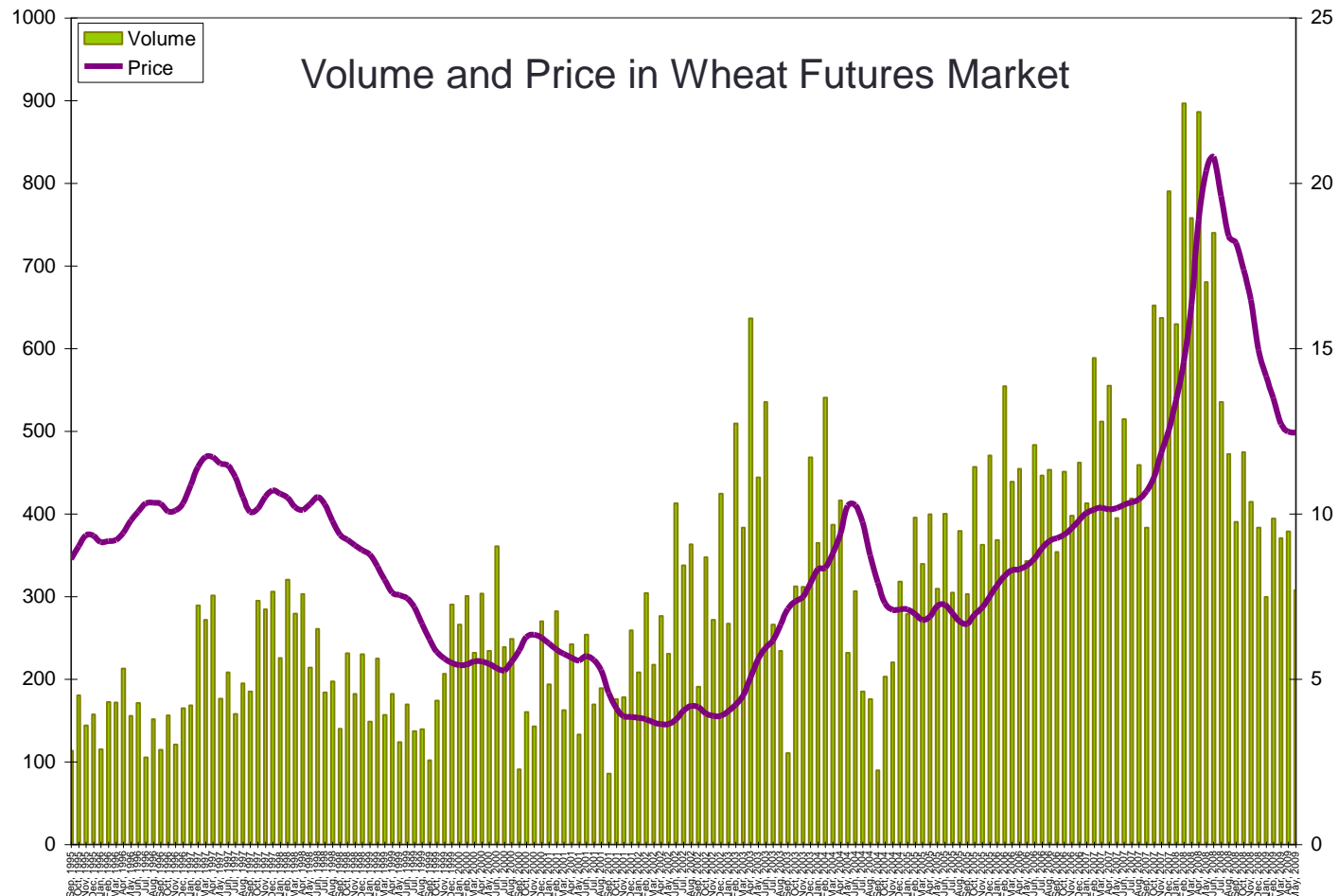
Source: A Note on Rising Food Prices by Donald Mitchell (The World Bank, 2008)

Linkage of agricultural prices: effects on “price spikes” in 2008



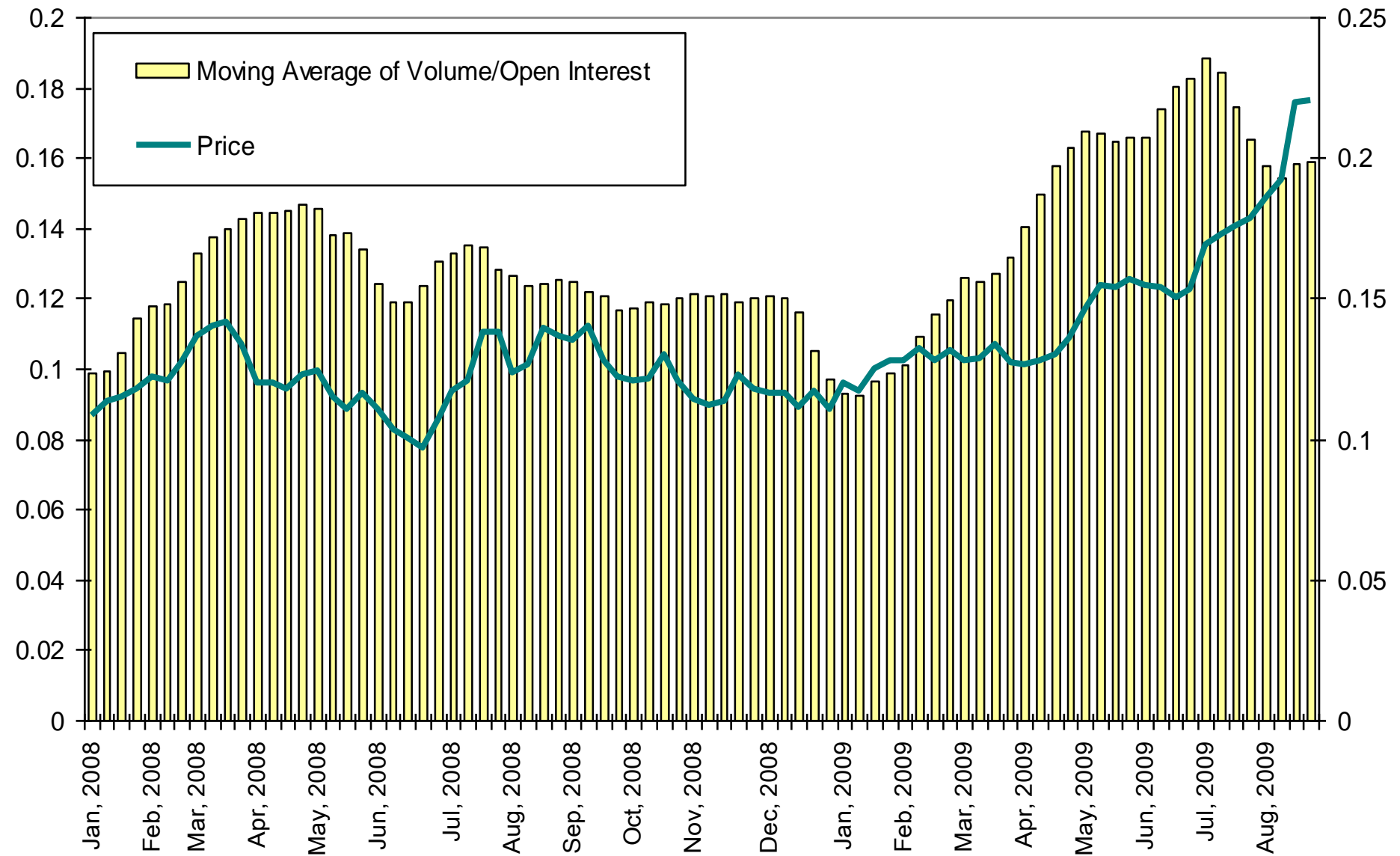
Increasing transaction and price on futures market

A study conducted by International Food Policy Research Institute (IFPRI) statistically indicates that the speculative activity in the futures market has been influential to the increasing agricultural commodity prices in 2007–08.



Source: When Speculation Matters by Miguel Robles, Maximo Torero, and Joachim von Braun (IFPRI, 2009)

Volume and Price: Futures Sugar Market



Current Situation (continued)

- At the cross roads, Thai agriculture includes forestry and comprises the majority of land managers whose own relative poverty may necessitate their taking a short term focus on cash, and in some cases, food production.
- The current situation of Thai agriculture varies markedly from its traditional role in ensuring abundant food from a bounteous environment.
- The late 1990s financial crisis provided an opportunity to reconsider social and environmental policies relating to agriculture and rural development, and a bifurcated production environment with self-sufficient and commercial agriculture coexisting.

Current Situation (continued)

- Policy responses to environmental degradation from over-extraction from resources, unregulated resource use, and privileged access to resource exploitation, have been political bargaining points rather than attempts at, for example, full cost resource pricing.
- The Office of Environmental Policy and Planning is developing new economic instruments to improve sector management, which may benefit from consideration of an emerging revival of traditional practices and Buddhist teachings.
- The current situation for Thai agriculture derives from traditional practices and the integration with global production. Traditions which allowed the transition from river valley agriculture to one of the world's important agricultural centres can be traced through the history of Tai and other ethnic groups as they absorbed new technologies and cultures in creating the Thai nation.