Malaysia Water Resources Management (MyWRM) Forum 2012

26 & 37 Novenber 2012

Water Resources for Food Security

Zalilah Selamat

Irrigation & Agricultural Drainage Division

Ministry of Agriculture and Agro-Based Industry Malaysia

Presentation Outline

- Food Security - Definition
- National Agrofood Policy (2011-2020)
- Present Water Use in Agriculture
- Emerging Issues
- Initiatives

"Food security exists when all people, at all times, have physical and economic access to sufficient, safe and nutritious food that meets their dietary needs and food preferences for an active and healthy life"

(World Food Summit, 1996)



Food availability:

The availability of sufficient quantities of food of appropriate quality, supplied through domestic production or imports

(including food aid).

Food access:

Access by individuals to adequate resources for acquiring appropriate foods for a nutritious diet.

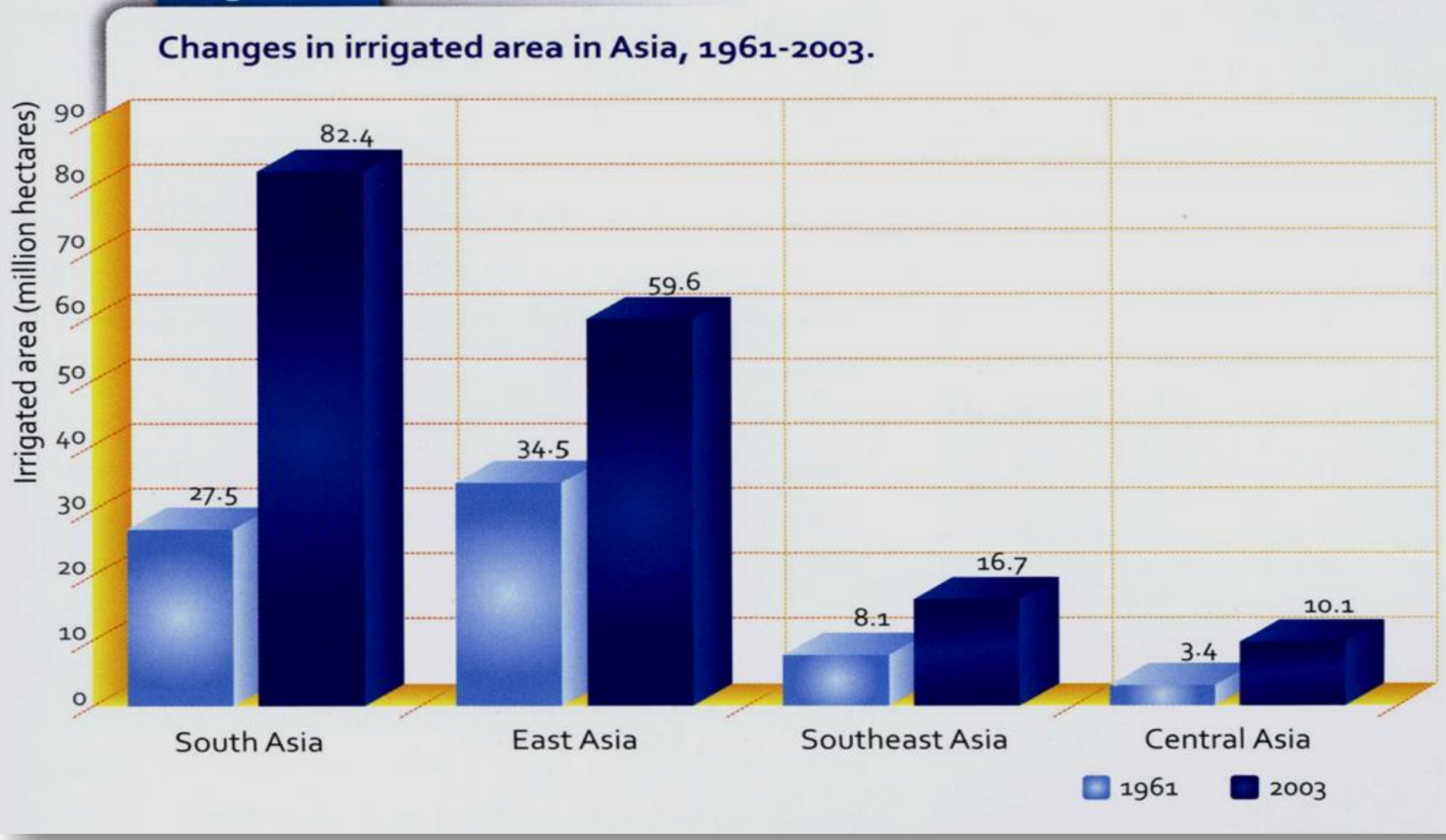
Utilization:

Utilization of food through adequate diet, clean water, sanitation and health care to reach a state of nutritional well-being where all physiological needs are met.

Stability:

To be food secure, a population, household or individual must have access to adequate food at all times.

Figure 2.



Source: Revitalizing Asia's Irrigation: To sustainably meet tomorrow's food needs, IWMI & FAO, 2009

Malaysia National Food Security Policy – The Driver

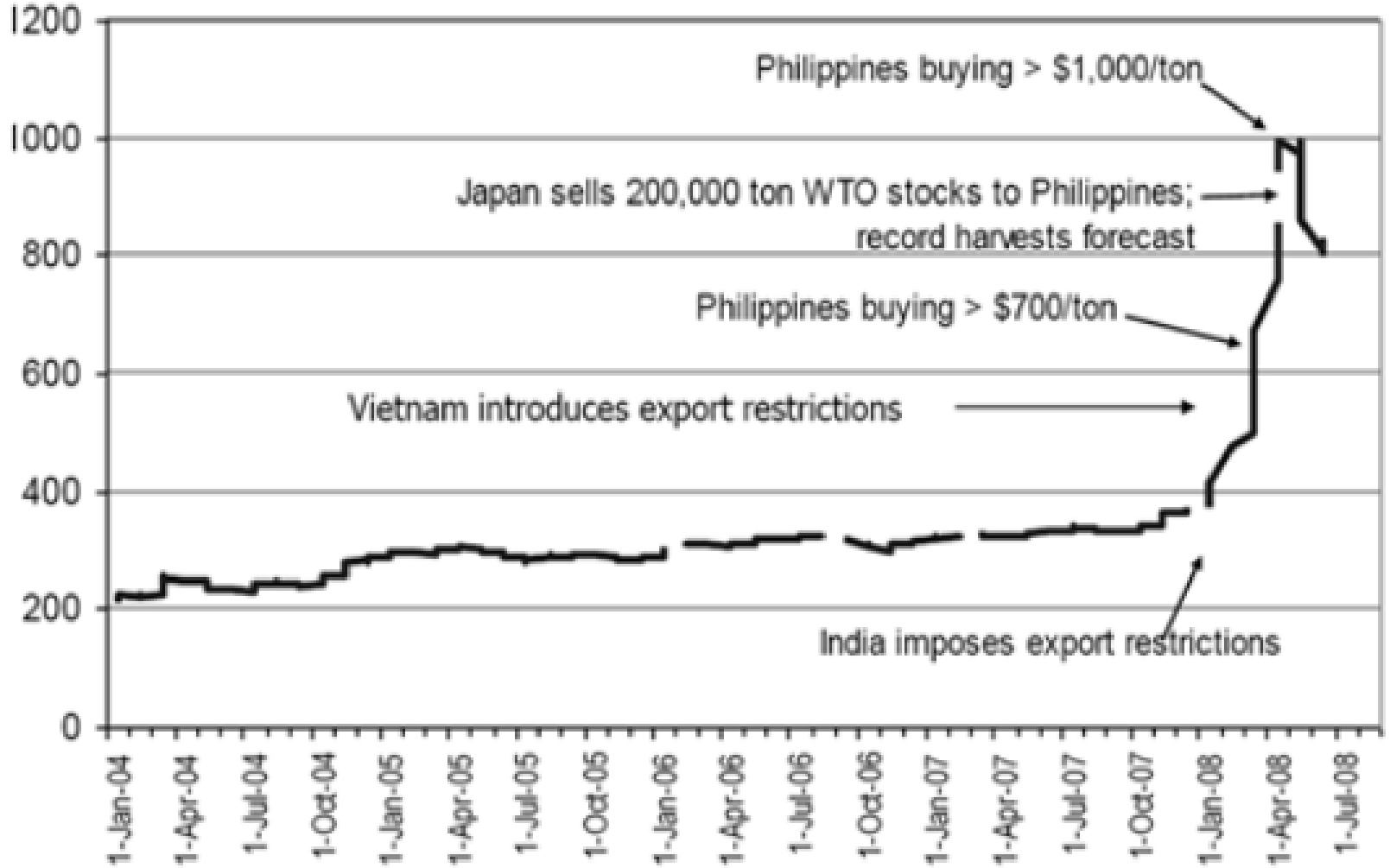


Figure 1. Rice price (US$/MT), 2004-2008

Source: Food and Agriculture Organization of the United Nations (FAO), Agricultural Statistics, 2009.

National Agrofood Policy (NAP), 2011-2020

….a reference and guideline in the transformation of national agrofood industry.

Factors Considered in Formulation of NAP's

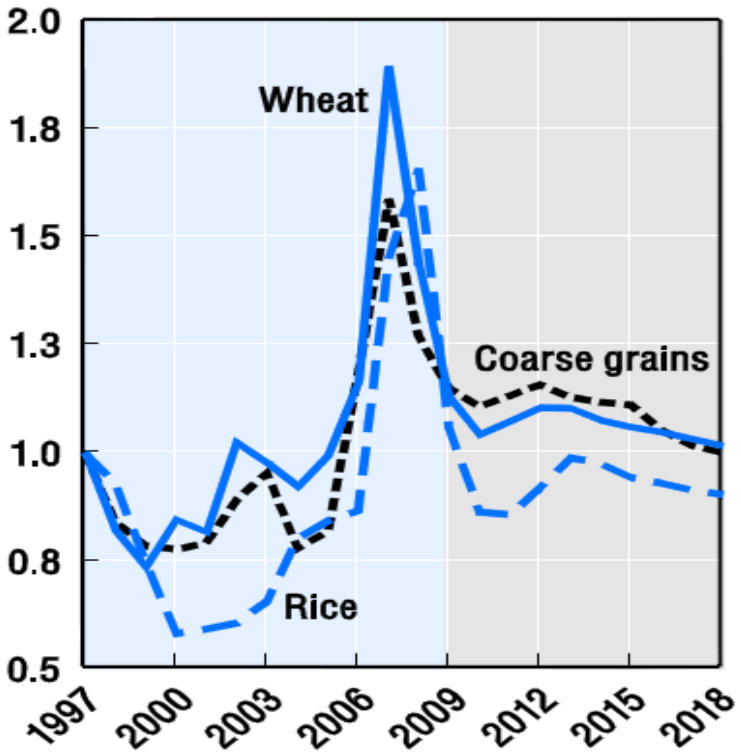
i) Global Scenarios
ii) Domestic Issues and Challenges

Global Scenarios

KEMENTERIAN PERTANIAN DAN INDUSTRI ASAS TANI MALAYSIA

1 Rising in Food Prices

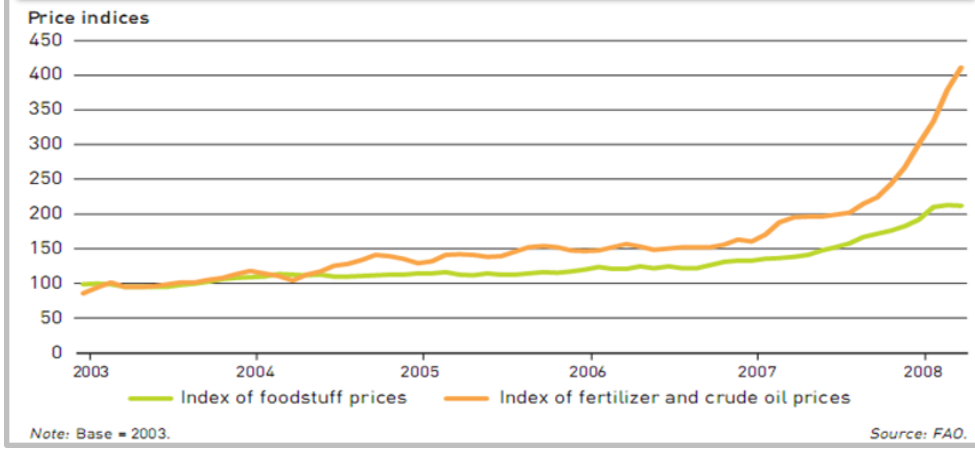
Global Cereal Prices, 1990-2020



Source: OECD & FAO

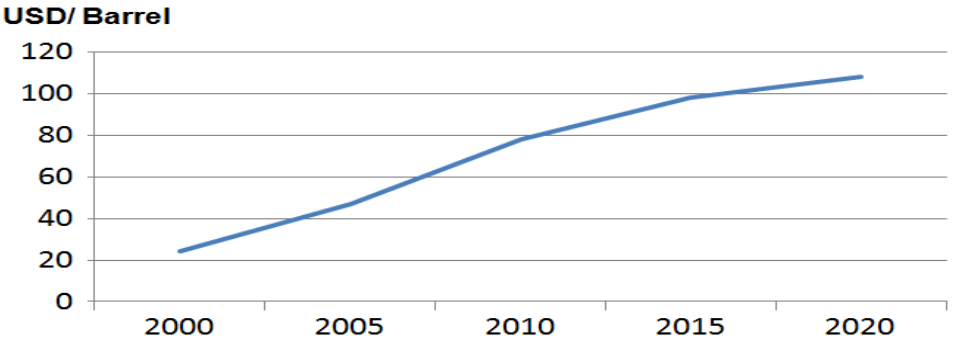
2 Increase in Agriculture Input Prices

Input Prices Outpace Food Prices



Note: Base = 2003. *Source:* FAO.

Crude Oil Prices Projected to Rise Steadily to 2020

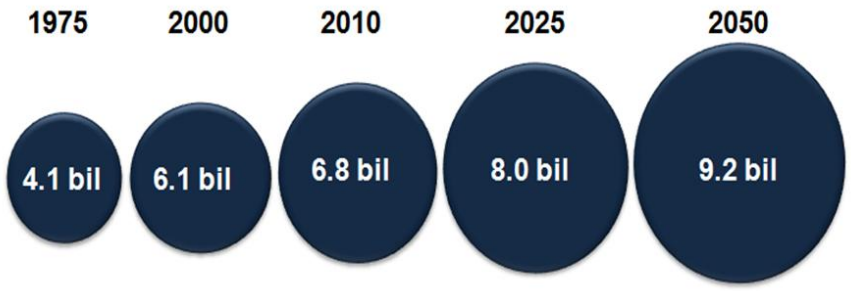


Source: OECD Economic Outlook

Global Scenarios *(Cont…)*

3 **Increase in Global Population**

World Population Growth



Source: United Nations Population Division

4 **Increase in Utilisation of Food Commodities for Bioenergy**

- Competition in land use for food production vs. Bioenergy (increase from 8% (2008) to 20% (2050))
- 40% global cereal production (2030) → bioenergy

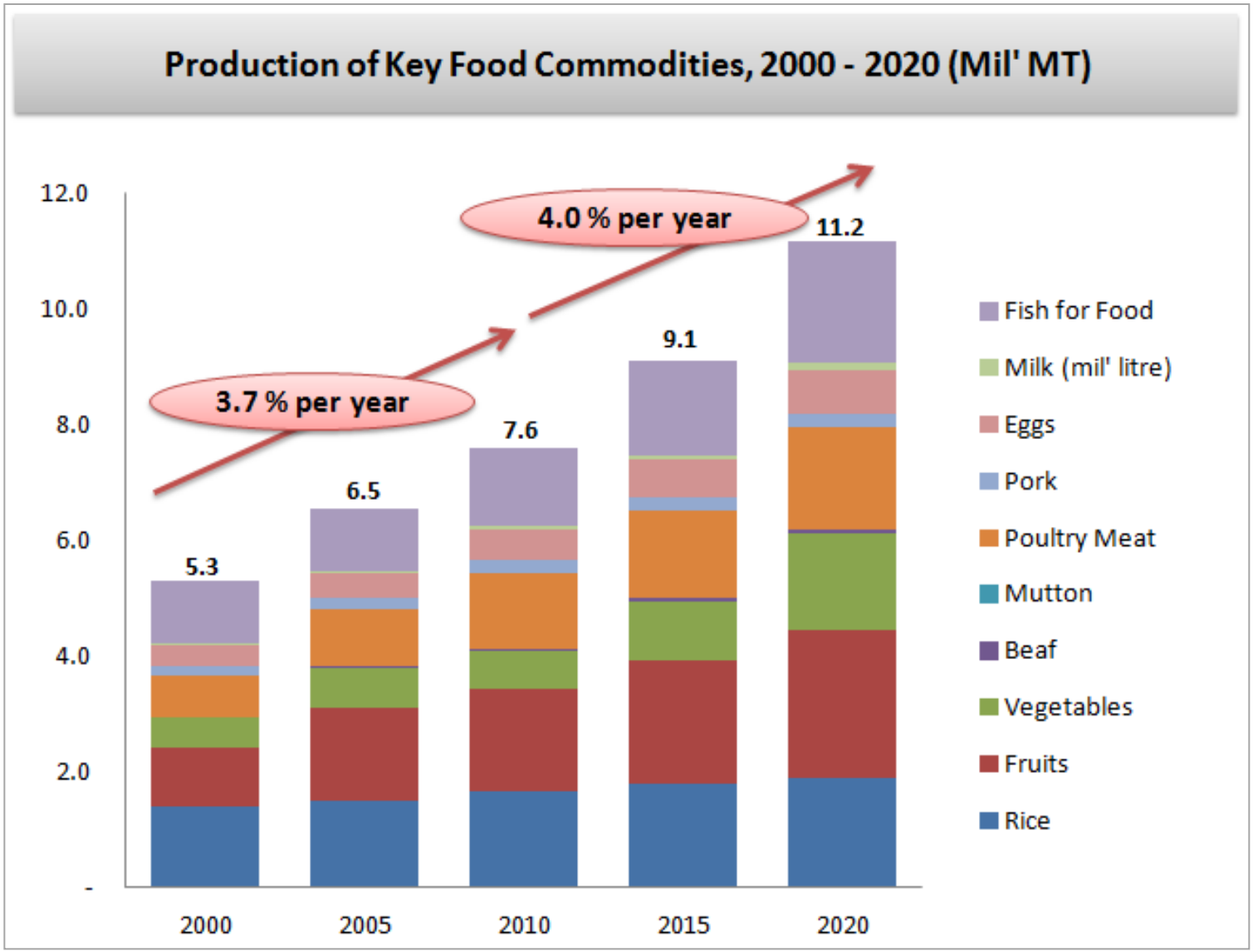
Global Scenarios *(Cont…)*

5 Impacts of Climate Change to Production and Biodiversity

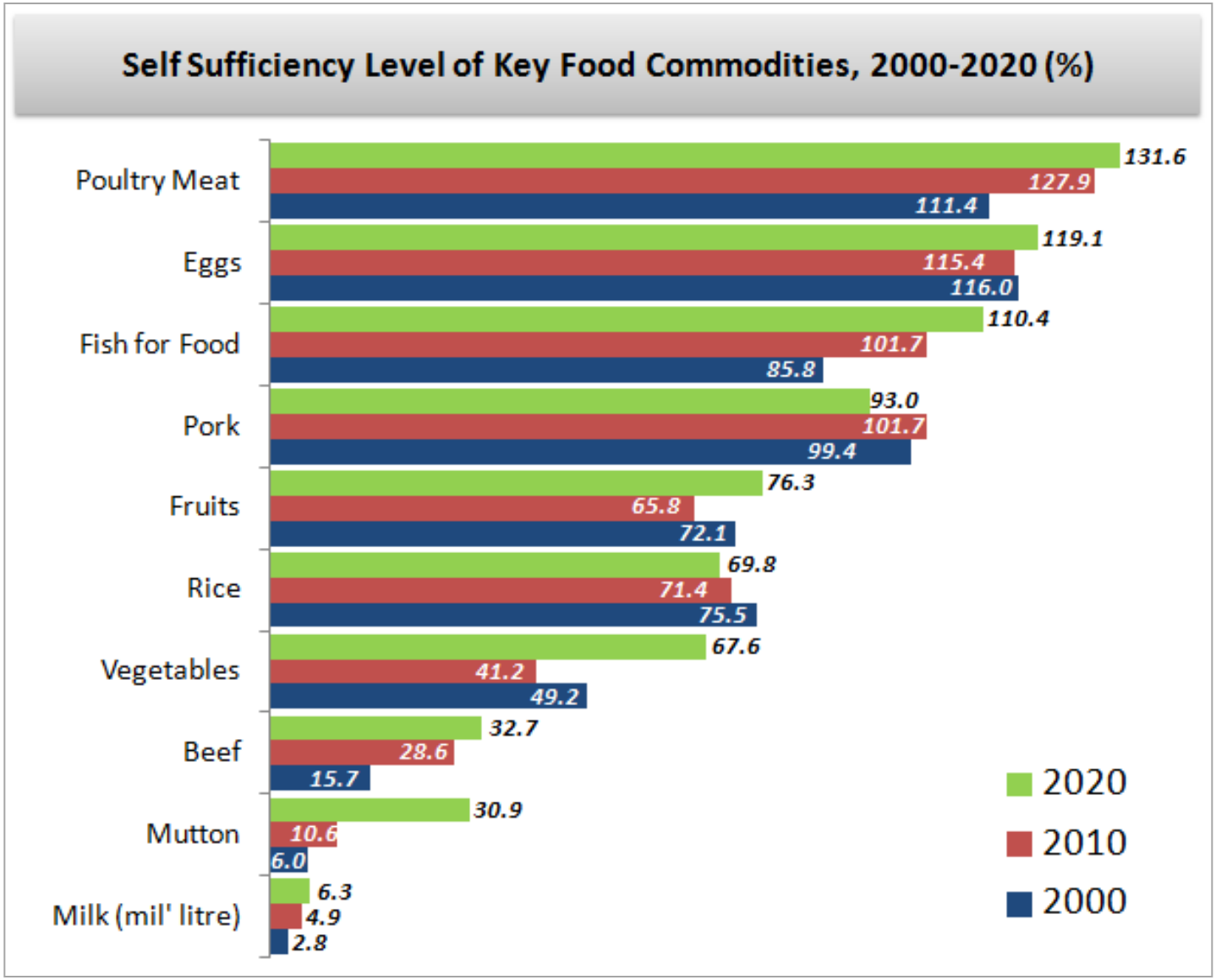
- Climate change will adversely affect the wheat production in South Asia by 2030 particularly in Greater Mekong Subregion.

Agrofood Industry's Target Until Year 2020

Production of Key Food Commodities



Self Sufficiency Level for Key Food Commodities



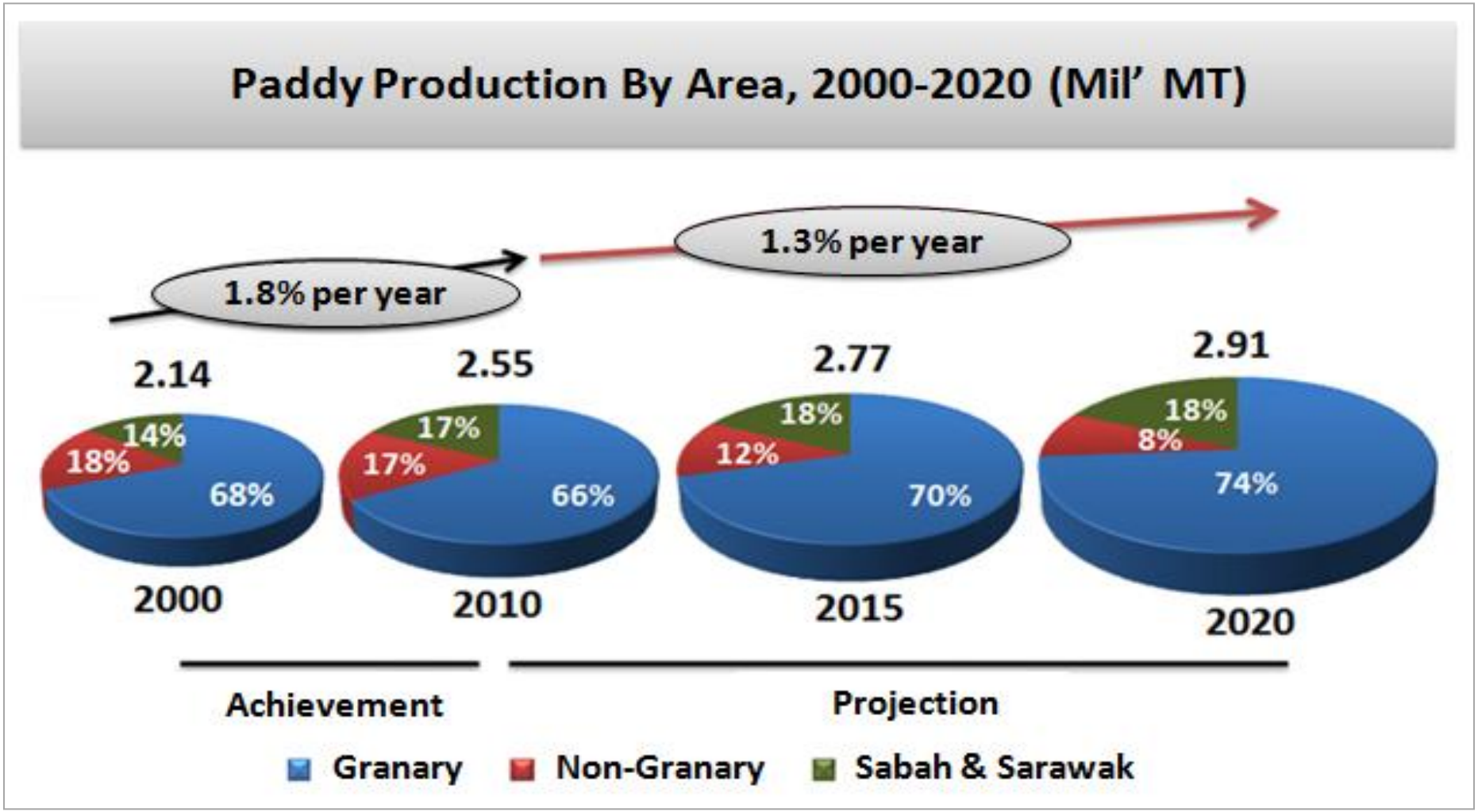
National Agrofood Policy (NAP), 2011-2020

NAP's Objectives

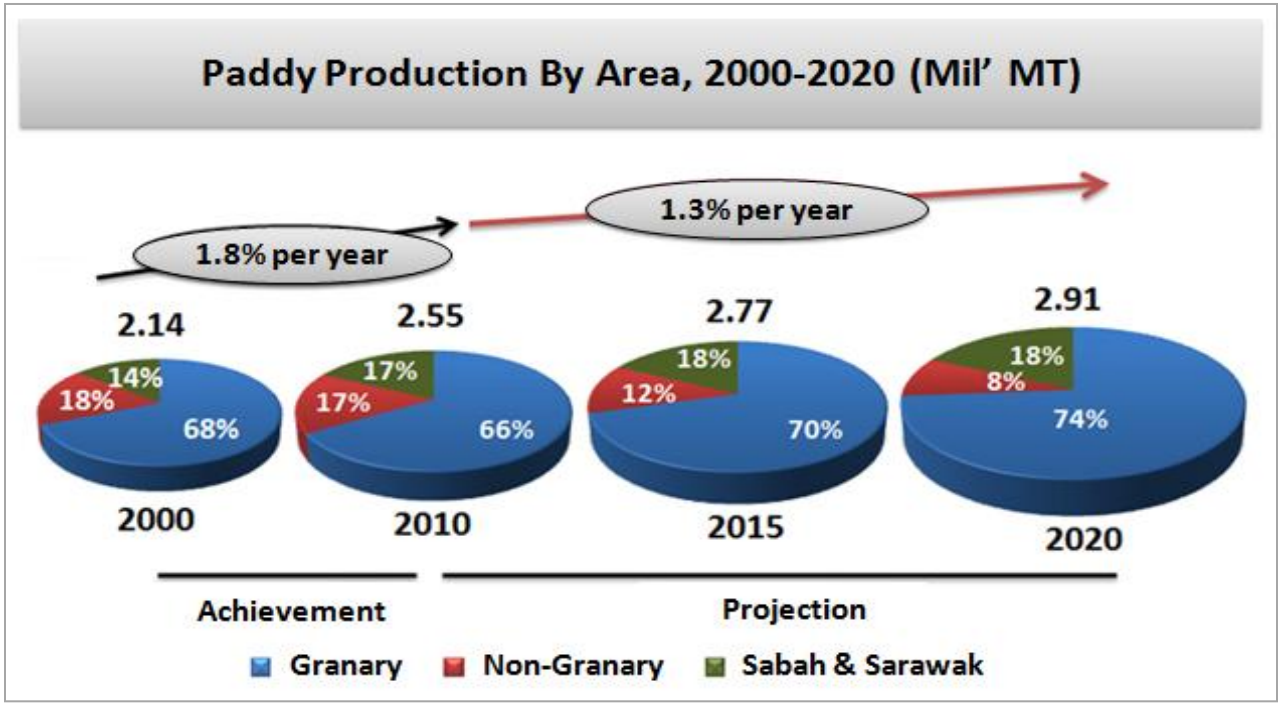
1. To ensure adequate food security that is safe to eat
2. To make agrofood industry as a competitive and sustainable industry
3. To increase agro based entrepreneur's level of income

Development of Specific Agrofood Industries

Paddy Rice

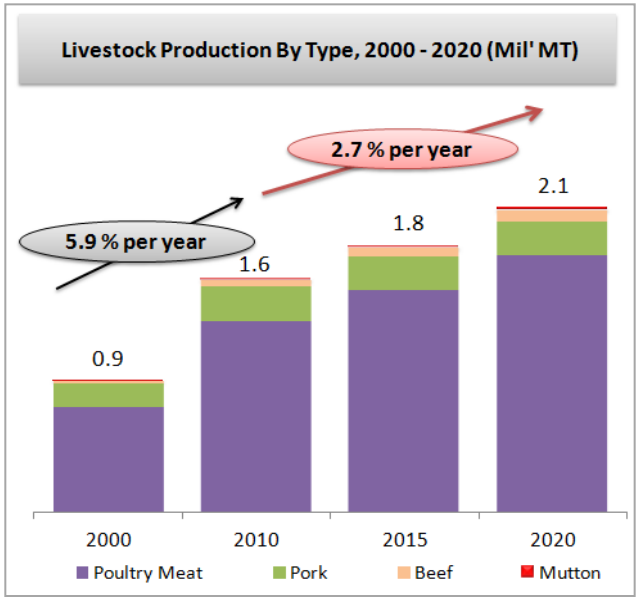

Paddy Production By Area, 2000-2020 (Mil' MT)
1.8% per year
1.3% per year
2.14
2.55
2.77
2.91
14%
18%
68%
17%
17%
66%
18%
12%
70%
18%
8%
74%
2000
2010
2015
2020
Achievement
Projection
Granary
Non-Granary
Sabah & Sarawak

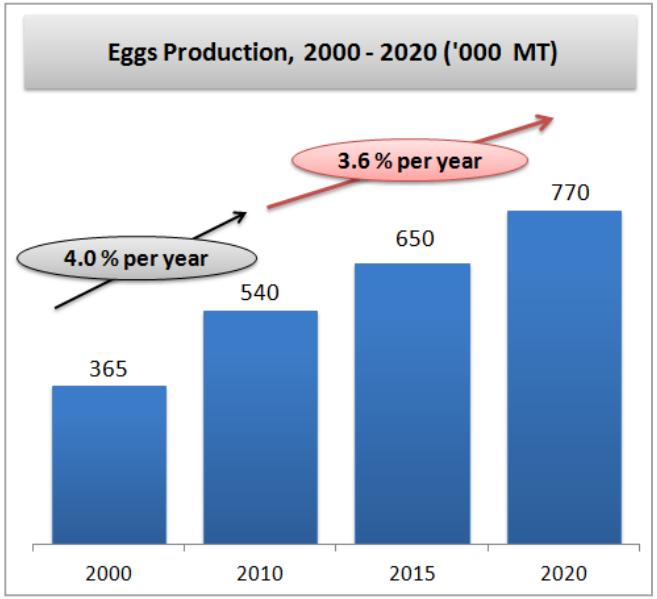
Paddy Rice

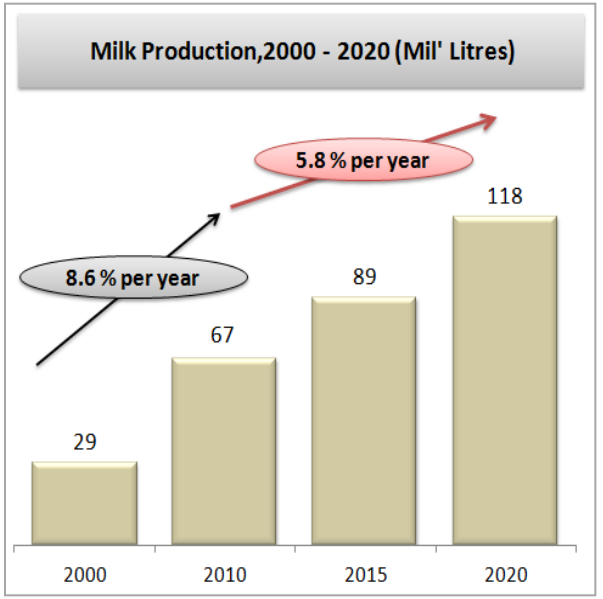


- Self-sufficiency level (SSL) = 70% (to be reviewed from time to time by taking into account food security, global market and the relative import costs)
- Production focused on the granary area and existing area in Sabah & Sarawak
- Initiatives to improve productivity (precision farming, water management & new variety)
- Stock piling of rice (45 days)
- Structuring incentives and subsidies

Livestock

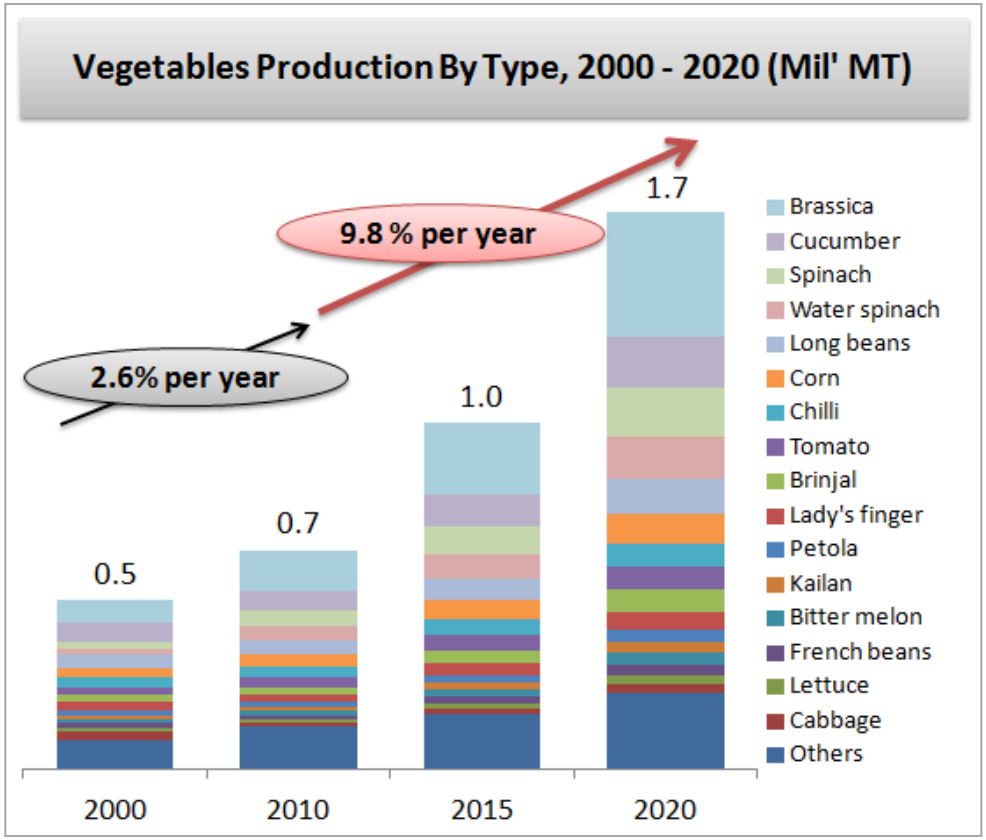






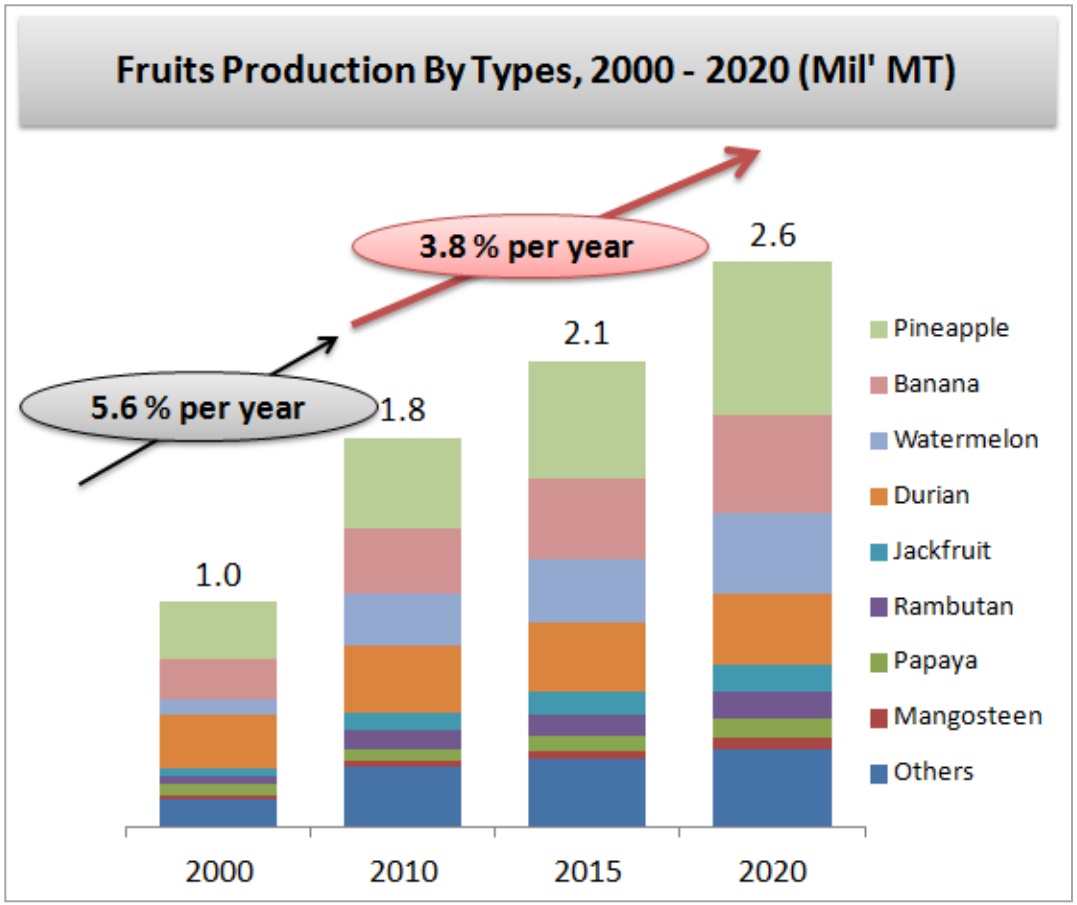
- Development of targeted area (TAC, Satellite Farm, Integration)
- R & D (Animal feed & breed)
- Towards Disease-free status
- Centralized slaughtering plants

Vegetables



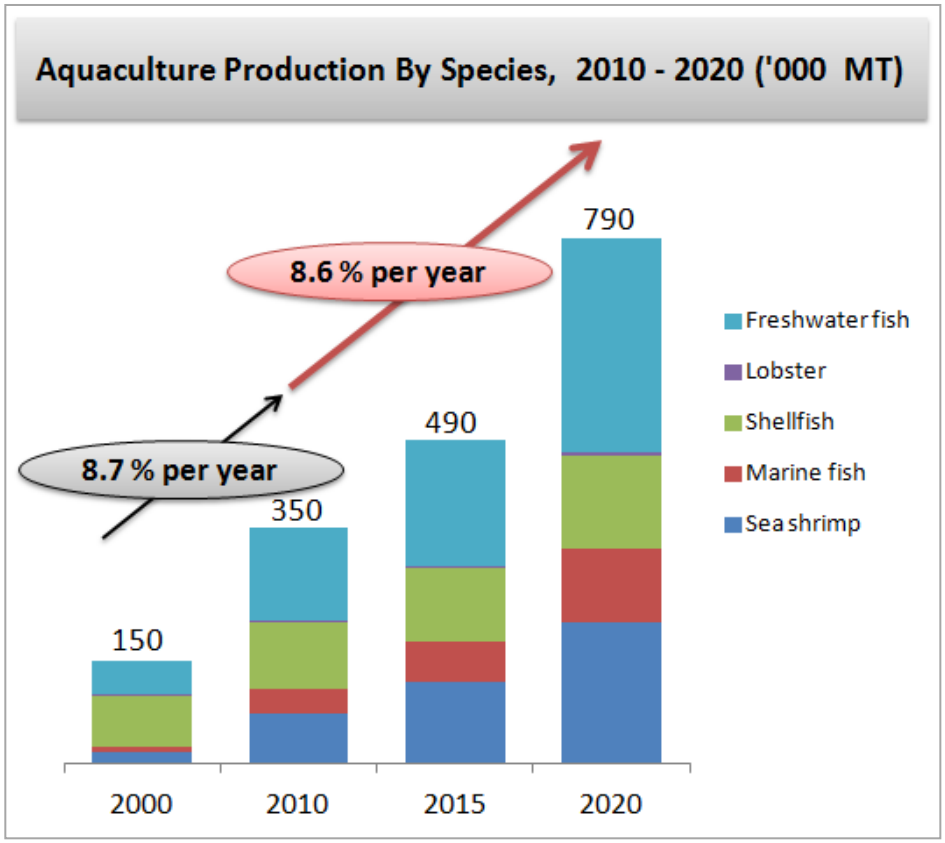
- Intensity level = 1.8 - 2.5 cycles per year (fertigation, precision farming, Home Protector Rain)
- Additional area of 8,000 ha; Permanent Food Production Park, vacant land, cluster projects, organic farming & crop integration
- Products - organic vegetable products

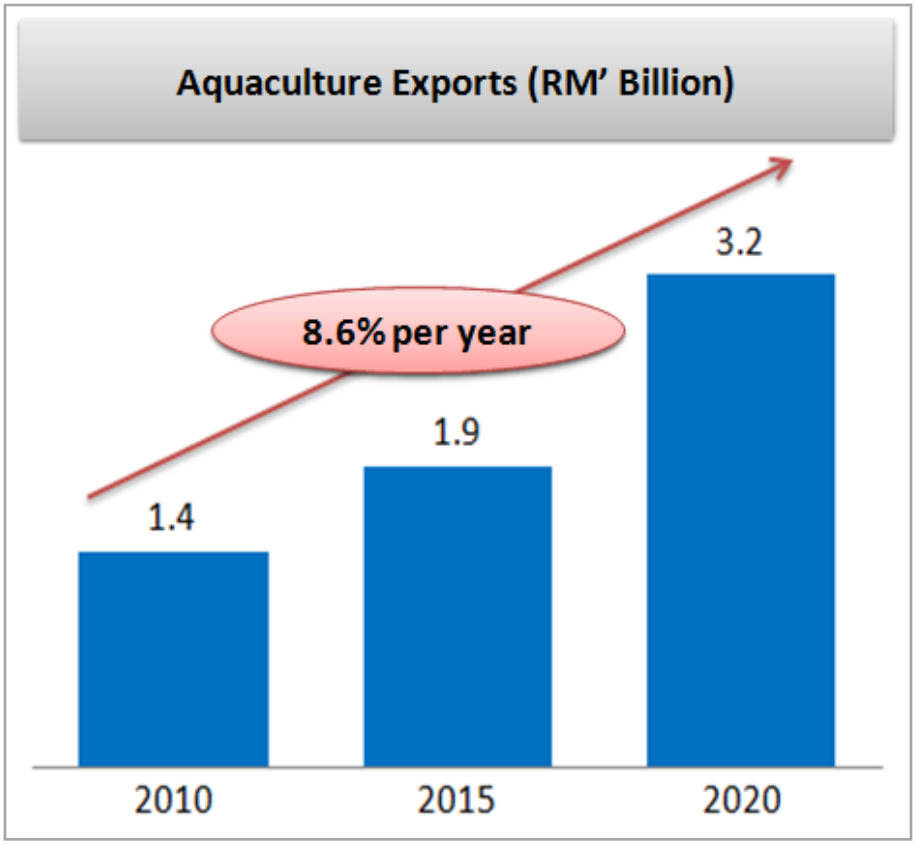
Fruits



- Increase Productivity (9.6 mt / ha - 12.9 mt / ha)
- Focus to the export fruits (pineapple, star fruit, watermelon, papaya, banana, mango, jackfruit, guava, durian, rambutan and mangosteen)
- R & D (varieties, disease control, quality assurance)

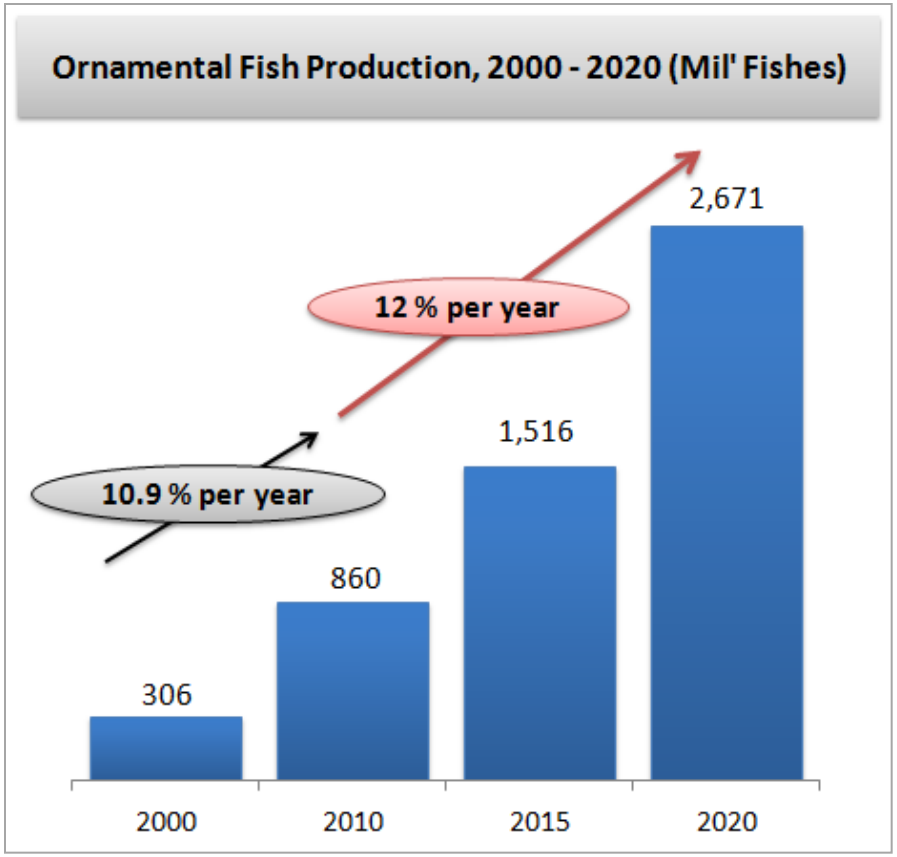
Aquaculture

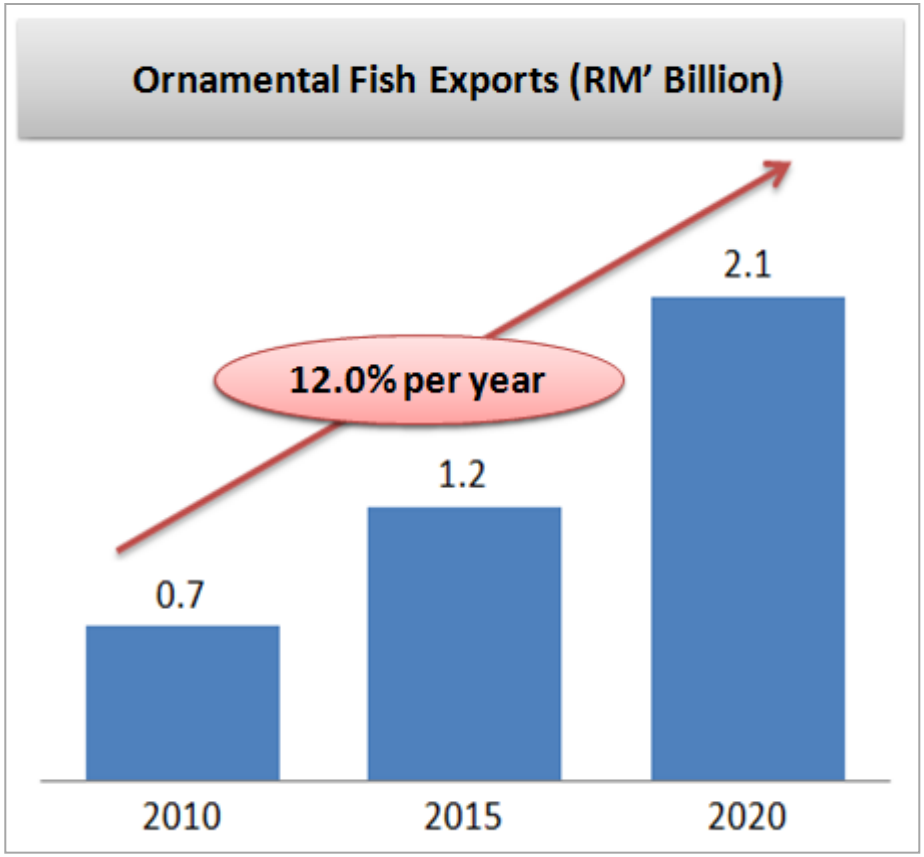




- Additional of new ZIA = 12,000 ha
- Export on concentration species (sea bass, tilapia, grouper, lobster & sea shrimp)
- Guarantee for consistency and quality of fry/seed supply
- R & D (aquaculture feed, seed & disease study)

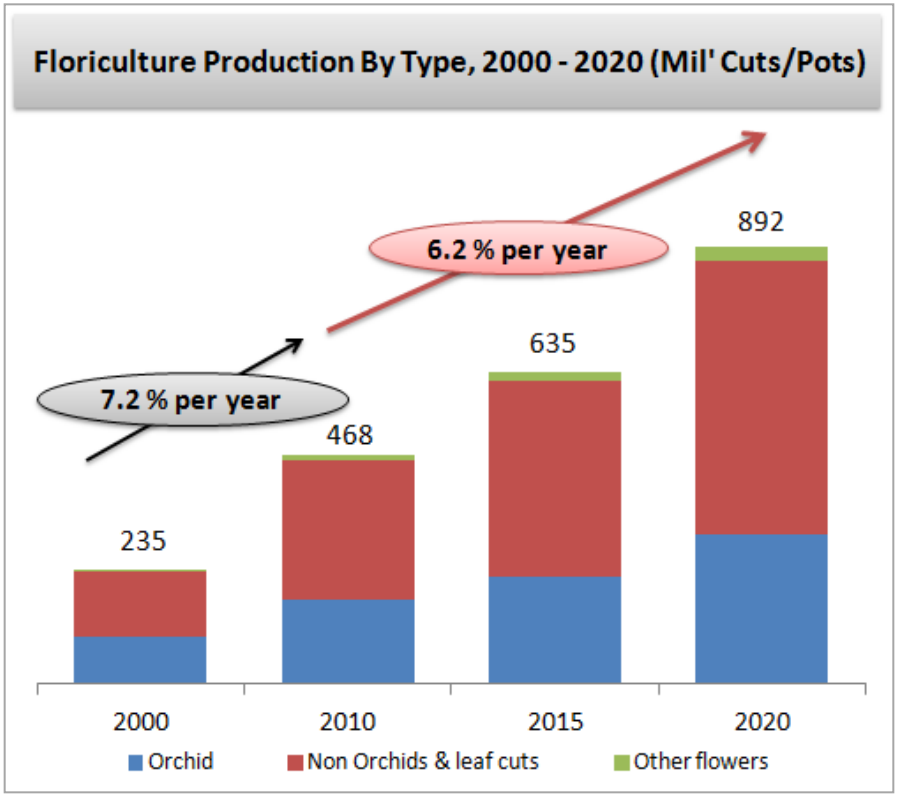
Ornamental Fishes

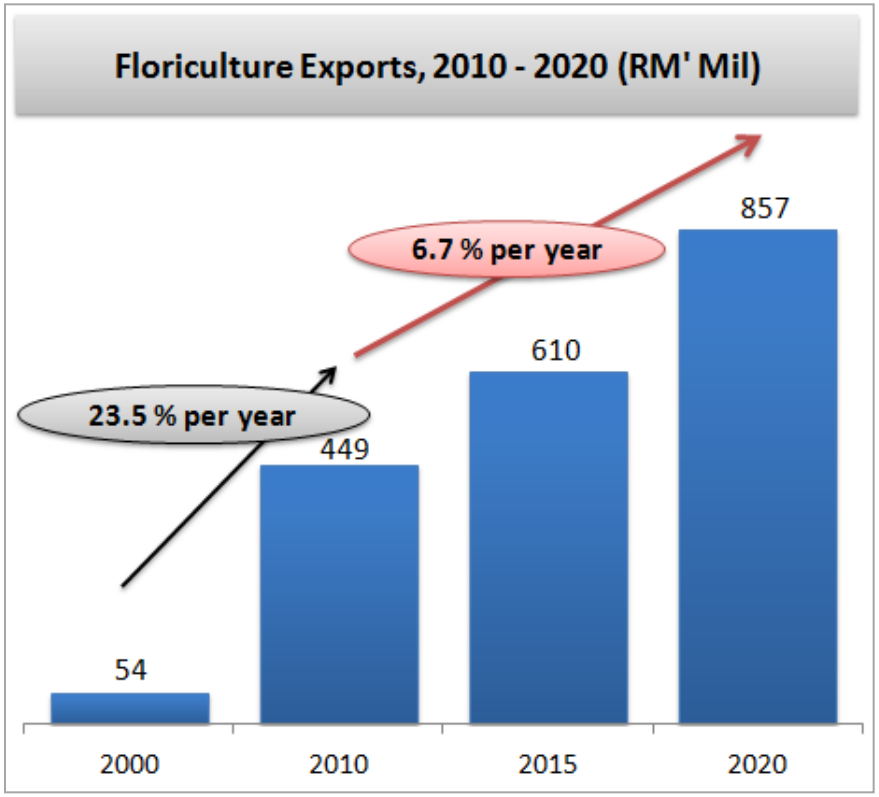




- Additional area (1,000 ha (2010) – 3,000 ha(2020))
- Species concentration - arowana, koi, gold fish, discus and marine ornamental fish
- Infrastructure to increase export shares
- National Ornamental Fish Research Center

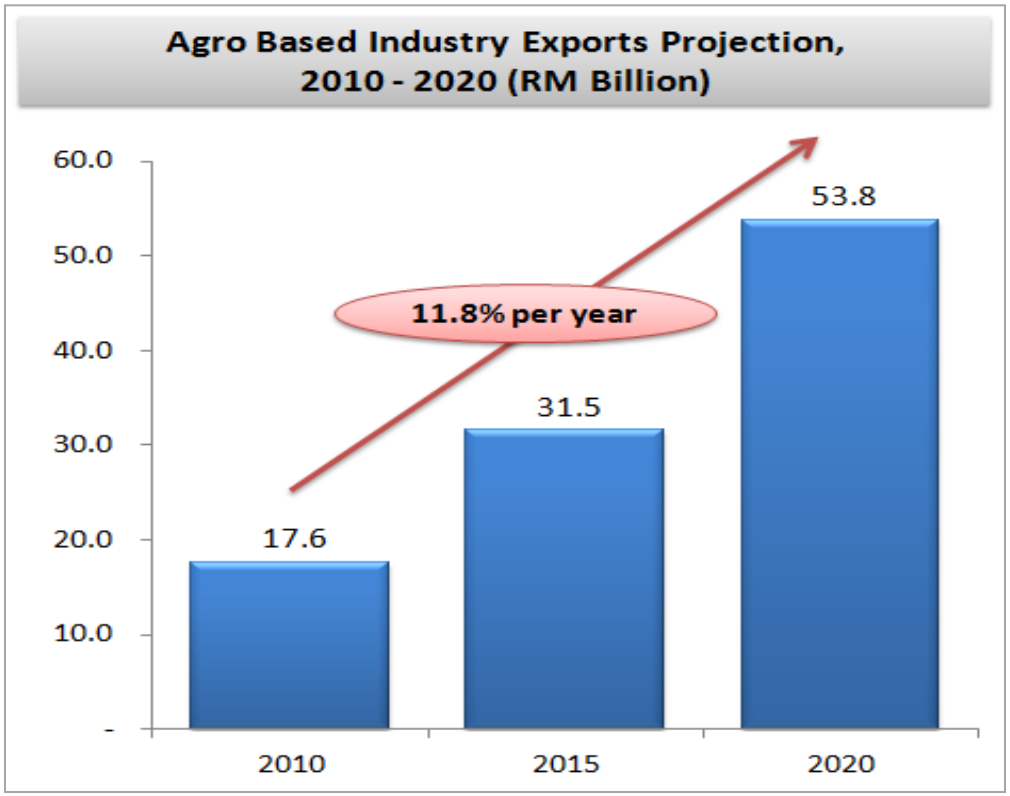
Floriculture





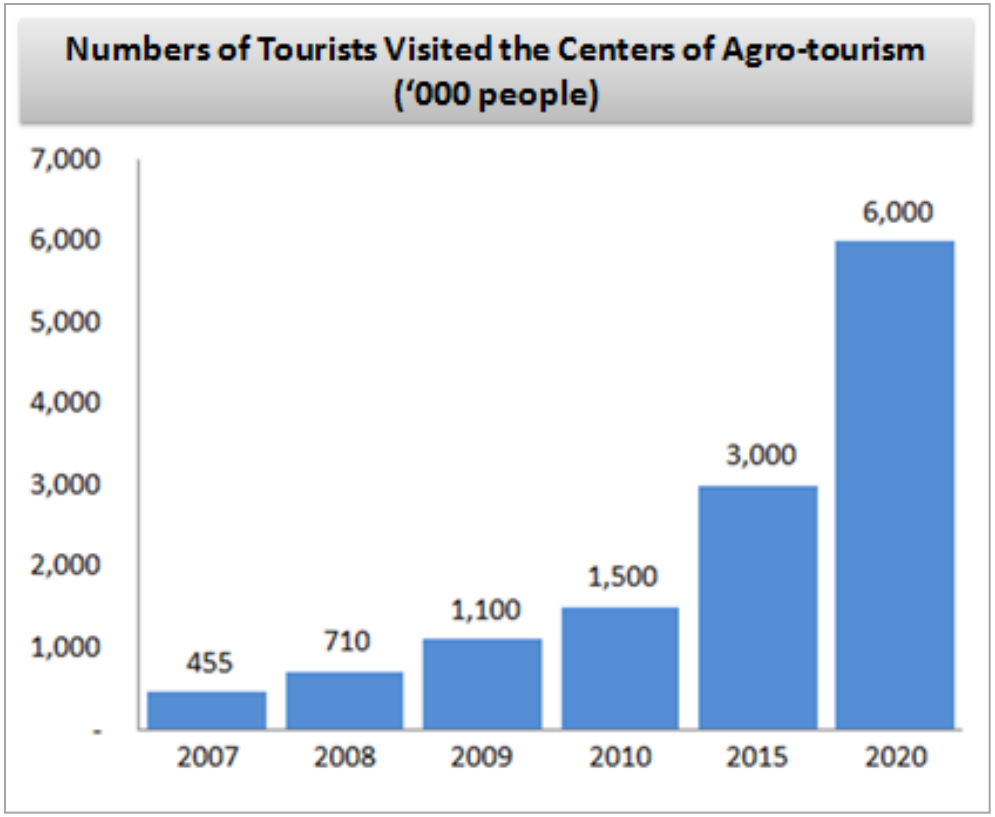
- Additional area = 1,100 ha (980 ha of low land; 120 ha of high land)
- Floriculture Agrotech Park & Nursery Commercial Zone
- Strengthening R & D (varieties, germplasm & biotechnology)

Agro Based Industry



- Develop an Agro Based Industrial Zone
- Concentrate on high value products (food ingredients, supplements, phytomedicines, personal care products)
- Increase market share (quality, method of packaging, labeling & branding)
- Recommendation brand of 1Malaysia Best
- R & D (extract of bioactive substances, food preservation & handling, packaging & products transportation)

Agro-tourism



- Diversification of Agro-tourism products (based on education, health, food, religion & culture, and others)
- Enhance the quality & safety products and location (star rating)
- Strengthening the cooperation with agro-tourism stakeholders (agro-tourism training modules)

Threats to Food Security

Disappearing arable land and forests

(land erosion, degradation, desertification, deforestation)

Development of biofuels

2004 - biofuel crops took up 1% (14 million ha. of the world's arable land)

2030 – 3.8%

Displacing crops that could be used for food causing shortages and driving up food prices

240 kg of maize – feed 1 person for one year

100 litres of ethanol ; enough to fill the tank of a SUV and run for a week

source: World Bank (2008) "Biofuels: The promise and the risks"

Threats to Food Security

Intense competition for water

in recent years, most of the increase in water withdrawal has come from rising domestic consumption and industrial processes.
Industrial creates greater economic value per litre of water, e.g
1 kg of rice needs 1,300 litres of water
1 kg of car needs 363 litres of water
Therefore per litre of embedded water, the car is in economic terms more than 130 times more valuable

Climate change

6th World Water Forum, Marseille.

Role of water in food security and meeting the world's food challenges: By 2050, when the global population is expected to reach **nine billion**, the world will need to produce **60-70% more food** to meet the needs of a larger number of people whose consumption patterns are influenced by higher incomes and increased urbanization.

At current rates of water usage in agriculture, that would require an additional **5,500km²** of water. Climate change will multiply the climate risks that already make agriculture vulnerable to uncertain rainfall patterns.

Present Use of Water in Agriculture

The agricultural sector is the highest water consumer and irrigation is devoted almost entirely to rice production

Irrigation Objectives

- **Increase land productivity production in 8 granary areas –**
  - **From 1.5 to 3.2 million tons by 2010**
  - **Yield from 4.0 to 6.5 tons/ha**
  - **Cropping intensity to reach 190-200%**
- **Increase water productivity**
  - **Irrigation efficient from 45% to 60%**
  - **Water productivity index to reach 0.3 - 0.5 kg/m3**
- **Increase labor productivity**
  - **Facilitate farm mechanisation**
  - **Precision water management / direct seeding**
  - **Automation**

STATUS OF FRUITS AND VEGETABLES IN MALAYSIA

Year	Hectarage (Ha)		
	Fruits	Vegetables	Total
2005	272,804	30,188	302,992
2006	253,679	32,839	286,518
2007	259,500	30,508	290,008
2008	247,462	31,466	278,928
2009	228,049	33,703	261,752
2010	264,099	33,563	297,662

Table 1: Trend of fruit and vegetable hectarage in Malaysia 2005-2010

*** *Perangkaan Agromakanan 2010., MOA*

STATUS OF FRUITS AND VEGETABLES IN MALAYSIA

Year	Production (mt)		Total Production (mt)
	Fruits	Vegetables	
2005	1,254,255	506,455	1,760,710
2006	1,109,531	506,424	1,615,955
2007	1,155,242	400,803	1,556,045
2008	1,193,279	432,513	1,625,792
2009	1,218,370	538,804	1,757,174
2010	1,292,230	466,934	1,759,164

Table 2 : Production trend of fruits and vegetable in Malaysia 2005-2010

*** *Perangkaan Agromakanan 2010., MOA*

TOTAL WATER REQUIREMENT

- The area under fruit cultivation has increased from 228,049 hectares in 2009 to 264,099 hectares in 2010.
- However for vegetables, the area under cultivation had decreased from 33,703 hectares in 2005 to 33,563 hectares in 2010.
- The total water consumption for various crop and vegetables production is increase from 2009 (1,432 MCM per year)to in the year of 2010 (1,607 MCM per year).

Water Requirement for Agro-based Industries

- The demand of water for agro-based industries would be higher 10% extra from total CWR of treated water.
- There are expected greater used of treated water for the agro industry namely processing fruits and vegetable in collection centre and food processing industry.

Production of livestock product

Commodity	2008	2009	2010	2011
Beef (M. Ton)	38,250	42,178	46,510	48,835
Mutton (M. Ton)	1,958.4	2,161.9	2,386.5	2,744.0
Pork (M. Ton)	195,070	206,026	233,400	237,100
Poultry meat (M. Ton)	1,162.57	1,202.00	1,295.60	1,334.47
Chicken/Duck eggs (Mill eggs)	8,715	9,270	9,826	10,358
Milk (Mil Lit)	56.49	62.30	67.00	70.87
Raw Hides and skin (M. Ton)	9,571	10,931	12,054	12,656

(Source : Livestock Statistics 2010/2011, DVS)

Consumption of livestock products 2007-2011

Commodity	2007	2008	2009	2010	2011
Beef (M. Ton)	148,846	150,696	156,318	162,357	168,273
Mutton (M. Ton)	18,6066.6	19,511.2	20,947.00	22,549.00	24,331.2
Pork(M.Ton)	206,487	201,920	212,654	230,114	229,820
Poultry meat (`000 M. Ton)	903.36	953.36	983.49	1,013.08	1,041.38
Chicken/Duck eggs (Mill eggs)	7,363	7,761	8,080	8,515	8,800
Milk (Mil Lit)	1,067.13	1,155.53	1,275.92	1,373.17	1,416.04

(Source : Livestock Statistics 2010/2011, DVS)

Water Requirement and Management

a. Water usage in livestock production

i. Drinking water
ii. Cleaning and cooling purposes
iii. Medications and Vaccines
iv. Slaughter houses, tanning and meat processing plant
iv. feed crops production for animal feed

b**. Effect of water usage in Livestock Management**

i. Pollution
ii. Diseases

Influence Factors for Drinking water in livestock

i. Animal

-species, size, habits, physiological stage, level of animals activity

ii. **Environmental**

- relative humidity, air temperature, water temperature

iii. **Management**

- water quality, type for feeding, water trough space

Average Daily Water Consumption for Livestock Animals in Malaysia

Animals	Ave. wt (kg)	Drinking water (Lt/head/day)*	Animal Population	Estimate water (l) consumption daily
Cattle/ Buffalo	200	25	1,057,736	26,443,400
Goat /sheep	30	11	713,171	7,844,881
Pig	120	28.3	1,813,695	51,328,360.9
Chicken /Duck	/100 animals	30	244,705,370	73,411,590
Total Daily Drinking water				159,028,231.9

*FAO

Water Source

i. Surface water
ii. Ground water
iii. Treated water

Average Daily Water Used for Servicing for Livestock in Malaysia

	Animal Pop.	cooling purposes lit /day/head*	Washing of feed equipment lit /day/head*	Waste, lit /day/head*	Total lit /day
Cattle & Buffaloes	**1,057,736**	n.a	22		23,270,192
Sheep and Goat	**713,171**	n.a	5	n.a	3,565,855
Pigs	**1,813,695**	3.8	19.2	102	183,976,890
Chicken /Duck	**244,705,370**	2.5	5.2	1.3	2,202,348,330
TOTAL					**2,413,161,267**

*FAO

Water used for local meat production 2011

Commodities	Production (Tons) or '000	Water (lit) used per kg carcass or per lit	Total water used (lit) as in 2011
Beef	48,840	15*	731,600,000
mutton	2744	15*	41,160,000
Pork	231,000	15*	3,465,000,000
Poultry meat	1,334,470	22**	29,358,340,000
Milk (mil. Lit)	70.87	1*	70,870,000
Total			**33,666,970,000**
Average water used daily			**92,238,273.97**

* FAO, **DVS

Daily Water Used in Pasture land

Farms	Pasture	Overall Pasture /htr	Active pasture/htr
PTH Jelai Gemas	B. decumbens	297.16	11l.56
PTH Pantai timur	B. decumbens	544.17	269.18
PTH Tersat	Br. Humidicola, setaria	527.504	504.504
PTH Ulu			
PTH Baru			
PTH Chalok	Humidicola	55.81	55.81
PTH Gajah Mati	Br, Humidicola, Guinea	47	47
PTH Kubang Kenyeng	Br, Humidicola, Guinea, Stylo	70	47
PTH Lenggong (Deer)	Guinea, Stylo	291.88	246.1
PTH Air Hitam	Br. Humidicola, setaria kazangula, guinea	n.a	n.a
Total active pasture			**1,655.634**
Total water used daily, (ltr)			**165,563,400**

10 lit/m^2 of water were used daily or 100,000 lit/ hectare/day-FAO

Livestock Populations in Different States of Malaysia 2011

States	Cattle & Buffaloes	Sheep and Goat	Pigs	Chicken & Ducks
Johor	132,680	103,869	292,174	63,532,501
Kedah	94,067	70,751	4,466	18,044,877
Kelantan	140,533	83,114	399	2,103,511
Melaka	33,825	73,801	41,486	14,648,691
Negeri Sembilan	50,954	71,665	446	15,672,483
Pahang	183,619	53,928	3,479	9,604,987
Pulau Pinang	15,127	13,563	318,968	14,417,275
Perak	85,585	57,190	512,418	47,227,859
Perlis	6,545	8,889	1672	2,942,453
Selangor	32,075	63,448	232,755	12,928,947
Terengganu	118,287	45,113	n.a	3,092,739
W.P Kuala Lumpur	120	152	n.a	n.a
Sabah	142,086	50,506	72,315	5,302,684
Sarawak	22,233	17,182	333,117	35,162,695
Total	**1,057,736**	**713,171**	**1,813,695**	**244,705,370**

(Source : Livestock Statistics 2010/2011, DVS)

Freshwater Aquaculture Production

	Pond		Other systems	
	Area (ha)	Yield (mt)	Area (ha)	Yield (mt)
2005	4725	41963	1817	20042
2006	5015	41275	1656	20375
2007	4762	48532	1738	21531
2008	4916	70631	2586	25484
2009	5029	113793	2220	37838
2010	5025	92833	1454	62566

Source: Department of Fisheries Malaysia

Water use in Aquaculture

- Water use in aquaculture include both – consumptive and non consumptive
- Water loss in ponds mainly caused by seepage & evaporation (consumptive use)
  - ~ 4680 mm/yr
  - 1 ha pond needs 46800m3 of water per year to compensate for the losses

Source: Department of Fisheries Malaysia

Water use in Aquaculture

- Estimated water use to produce 1 kg of fish (Malaysia) based on 2010 pond production:
  - $E_8 + S_5$ ~ 46,800 m3/ha
  - Production ~ 18,474 kg/ha
- ~ 2.5 m3/kg is comparable to Verdegem, Bosma and Verreth (2006) – 2.7 m3/kg

Source: Department of Fisheries Malaysia

Trends in water use

- *Trends in the last decade:*
  - High water use in ponds in comparison to terrestrial agricultural protein production systems.
  - Severe water competition growing with alternative users.
  - Massive damming and urbanization in Asia diverting water to coastal cities and agriculture.

NEW STRAITS TIMES 2 November 2012

Malaysia gets help to deal with food security issues

KUALA LUMPUR: The best minds in the world will partner Maslaysia in its bid to so;ve problems in areas such as health, nutrition and food security,..

….Najib said that the key to to sustaining food security was to boost food production through innovation, better technology, improved irrigation and quality of manpower.

…food security had increasingly become a critical issue in Malaysia and the Asian nations, as the reguon grappled with challenges such as climate cjange, increasing popilation and a finite amount of arable land.

Irrigation in the Future

- **Clear policy**
- **Key irrigation objectives**
  - **Land productivity**
  - **Water productivity**
  - **Labour productivity**
- **Need to supplement experience with ‘facts and figures’**
- **Propagate success stories**
- **Accelerate through modernization**
- **Explore alternative water sources (groundwater, rainwater etc)**

Irrigation Modernisation

- Granary areas viewed as efficient and high yielding production centers
- Efficient use of resources *(land, water, labour, finance, environment)*

Irrigation Modernisation

- Sustainability
  (land productivity, water productivity, labour productivity, cost-effective, improve income and living and health conditions, preserve environment)

- Modernisation through upgrading
  (Infrastructure, technology, management, institution)

Drainage &
Irrigation
Infrastructures

TELEMETRY SYSTEM

Rainfall Station

Repeater Station

Computer

Master Controller

Rainfall & Water Level Station

Water Surplus/Deficit for Muda Irrigation Scheme under Climate Change Scenario (Projected Condition with Initial Full Dam Supply)-MCM

Month/ Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2025	1447	1445	1225	1017	832	817	737	750	782	1021	1021	1001
2026	1000	1021	862	773	594	582	521	545	343	189	-37	46
2027	-4	6	-163	-189	-134	-13	-16	43	303	286	430	442
2028	436	464	311	138	-4	-56	-34	2	-161	97	174	129
2029	132	162	13	-140	-136	-67	-2	-5	-173	163	-14	-49
2030	78	171	44	54	86	127	183	425	364	523	572	552
2031	547	569	514	698	599	941	956	1003	867	898	859	799
2032	766	776	624	513	490	553	757	931	992	1019	1053	1030
2033	1003	1040	833	643	548	672	670	836	718	874	885	929
2034	937	962	813	663	594	576	549	584	430	194	117	66
Average 2025-2034	634	662	508	417	347	413	432	511	447	526	506	495
2041	1456	1453	1335	1280	1216	1368	1375	1509	1509	1509	1425	1427
2042	1399	1410	1214	1060	1028	1036	1051	1250	1094	1085	900	870
2043	781	804	607	470	408	427	401	453	523	471	584	701
2044	740	787	627	437	755	943	1019	1097	983	1020	827	770
2045	717	715	561	361	184	149	177	210	120	268	224	197
2046	181	195	53	-142	-166	-46	-51	2	68	555	589	604
2047	610	636	470	398	298	330	370	384	189	47	-106	-61
2048	-70	-15	-194	-210	-63	-82	-25	80	-64	173	-23	-156
2049	19	50	-115	-152	-8	-26	-7	11	-88	51	55	18
2050	-12	17	-140	-197	-105	-29	242	342	344	535	459	425
Average 2041-2050	582	605	442	330	355	407	455	534	468	572	493	480

Assume full dam storage at Jan 2025 and Jan 2041- 1509 MCM.

WATER RECYCLING

Improving irrigation efficiency

WATER RECYCLING

High Impact Agricultural project such TKPM used open Micro Irrigation System – Drip system to supply water to root zone

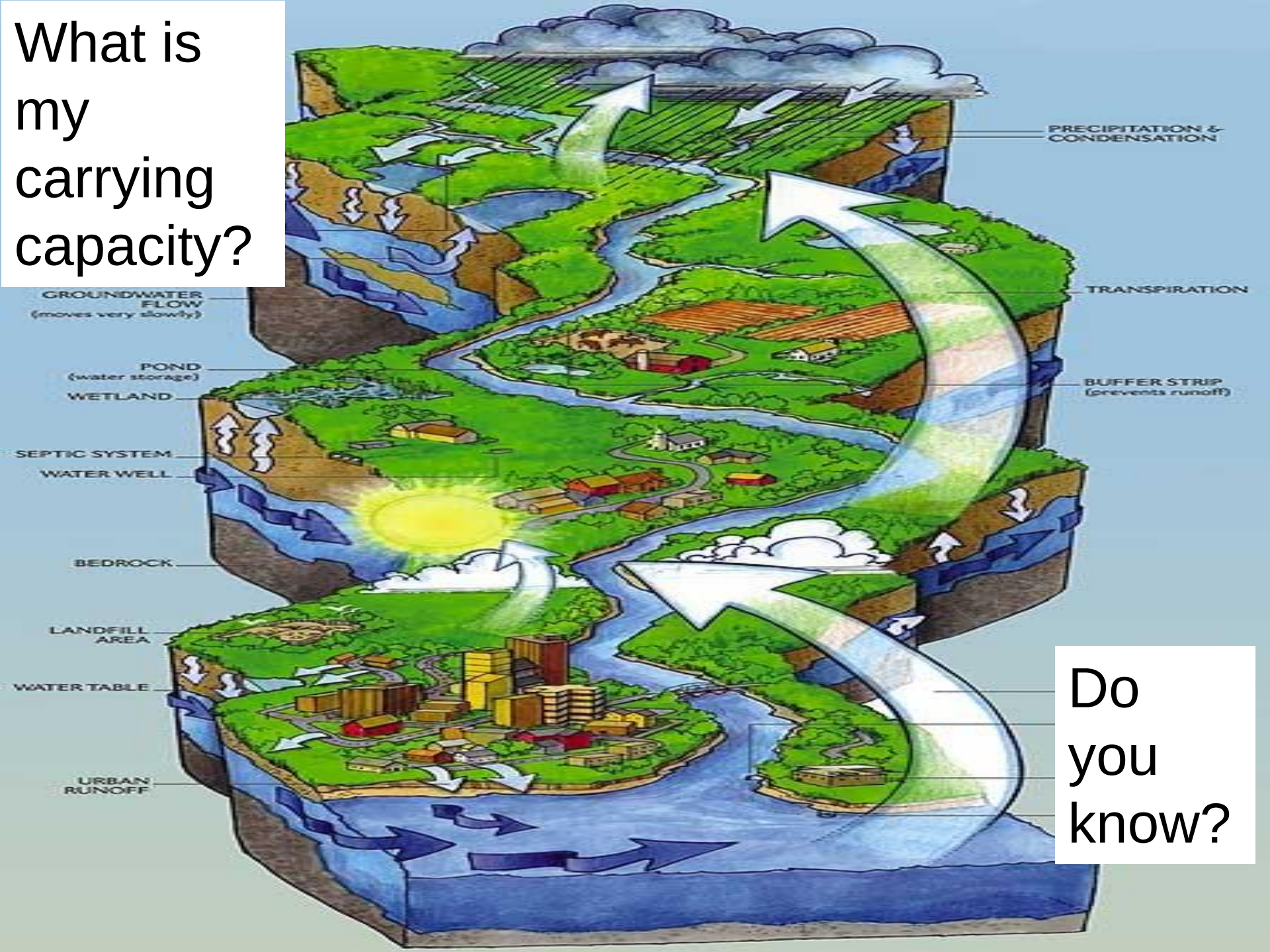
Micro Irrigation system - Drip

Fertigation under rain shelter – well known irrigation system that combination both water and fertilizer to be supplied direct to the plant medium

- rapid development of cage system
- recirculating systems

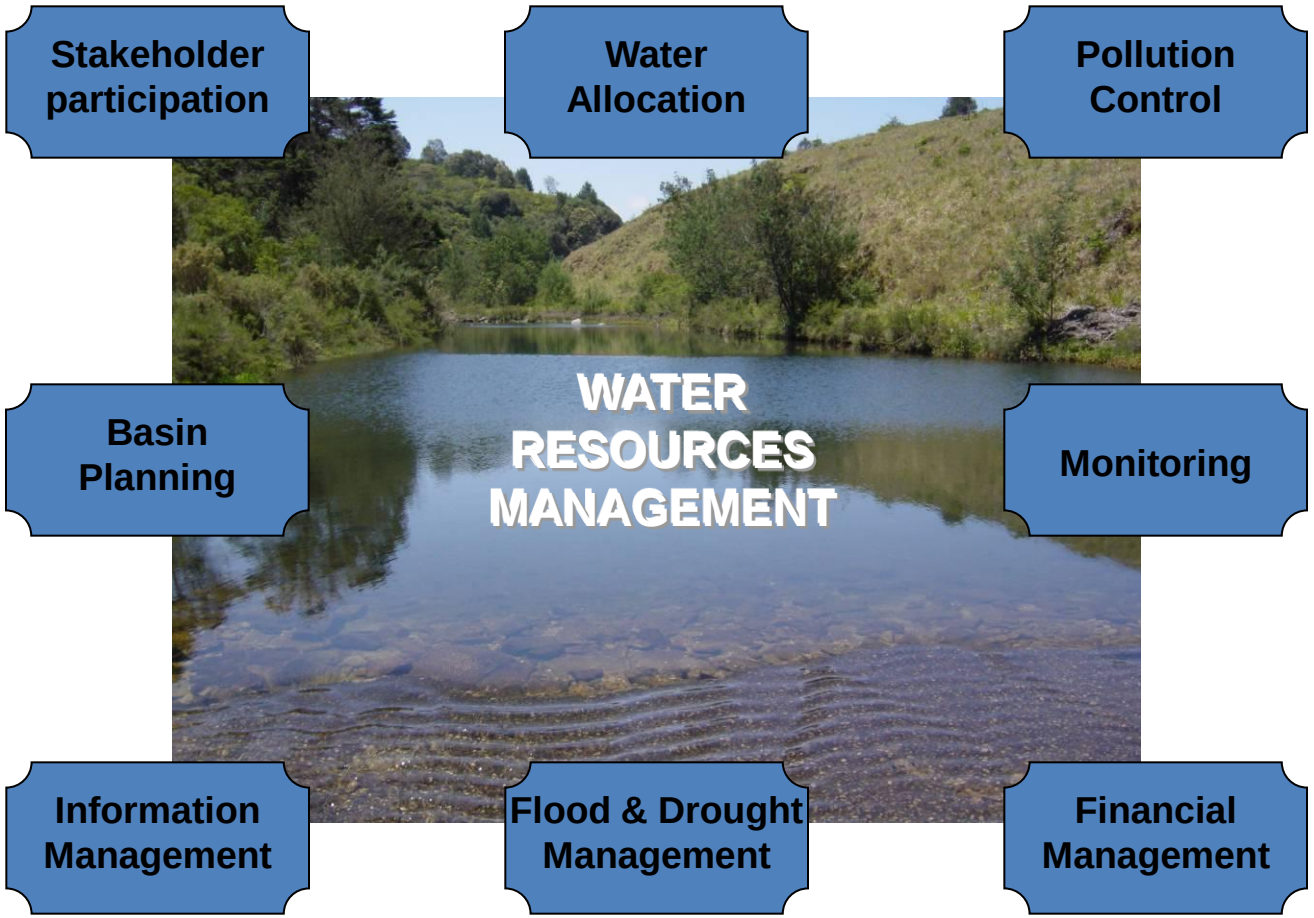

AROWANA PONDS TO BE GAZZETED
600 ACRES
Strategic location
Near highway
Complete infra
2NDRY CANAL
400 ACRES
Right Temperature,Ph?..
The Intake Head Work Structure

What is my carrying capacity?

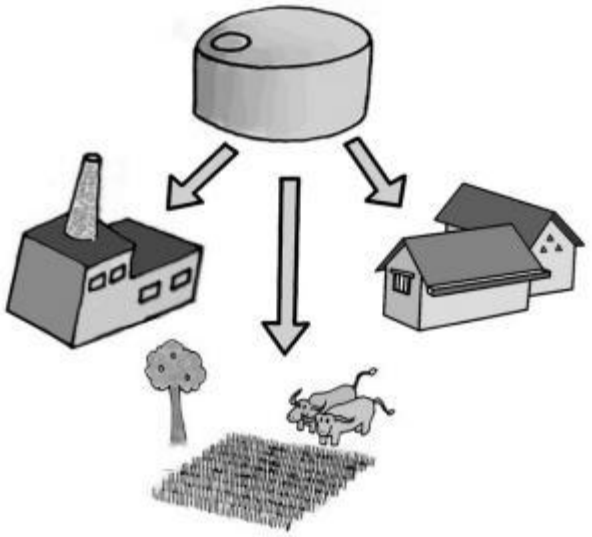


Do you know?

Key WRM functions



Everyone is involved…



including the environment !!

More to think about…

- Water Use Efficiency / Productuvity
- Water Allocations
- Efficient/Water friendly Infrastructures
- Modernisation
- investments
- Water Demand Management
- Participatory Approach

  Intra sector and Inter Secctor

  (NRE/MoA/industries;

  private operators/farmers/Water User Groups

moa INCORPORATED
KEMENTERIAN PERTANIAN DAN INDUSTRI ASAS TANI MALAYSIA

THANK YOU...