TRANSFORMING
SWAMP BUFFALOES
TO PRODUCERS OF
MILK & MEAT
through
CROSSBREEDING & BACKCROSSING

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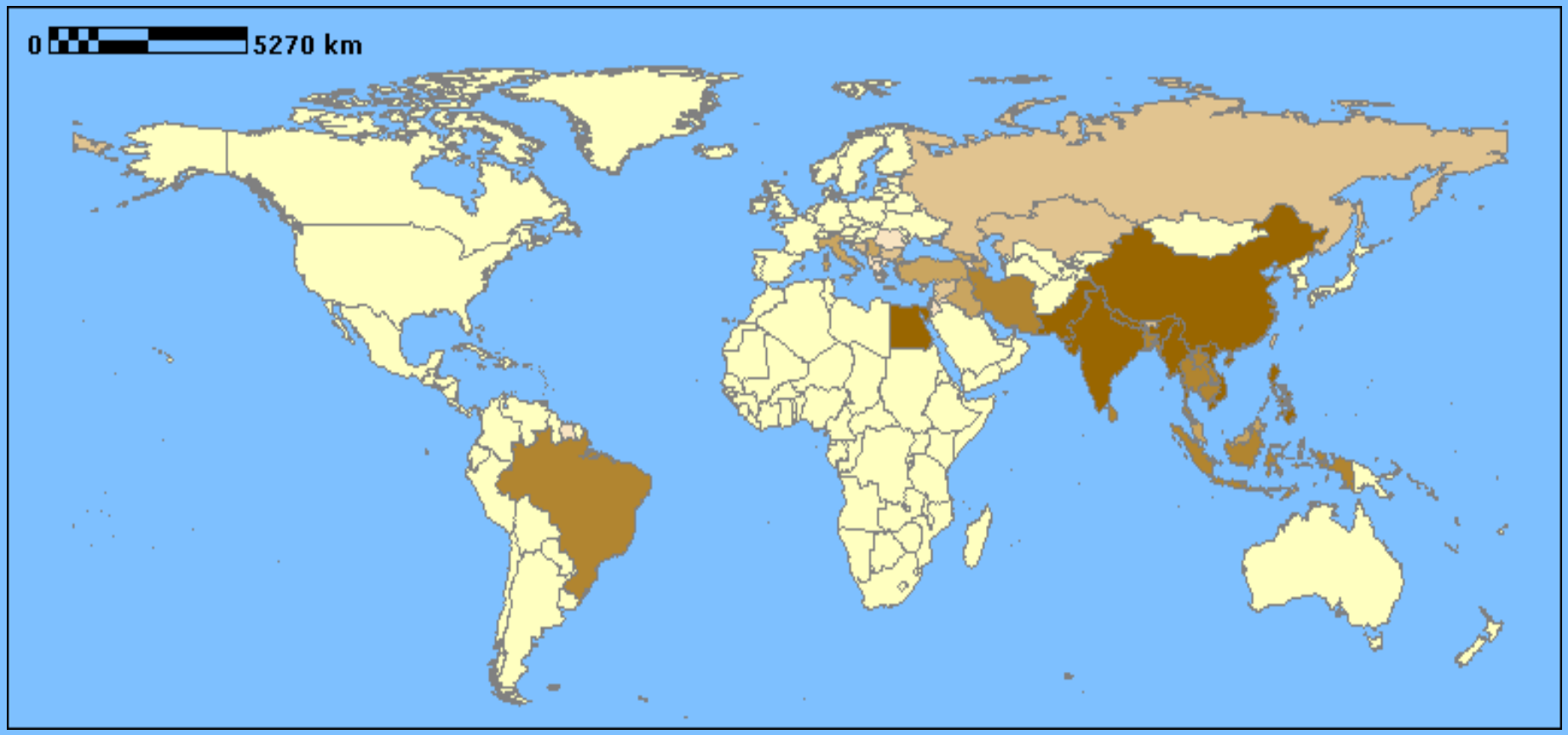
ATLAS OF WORLD BUFFALO POPULATION



Water Buffaloes – World Population

2,504,000	more
447,000	2,504,00
18,000	447,000
2,000	18,000
Less	2,000
Not Available	

Source: FAO, 2004





1. Increase in demand for animal derived products such as meat and milk.

2. Significant increases in commercial production of meat from monogastric animals such as swine and poultry.

3. Among the faster growing economy countries, there is a deliberate effort to develop the dairy industry through massive stock infusion of dairy animals.

What are the implications of these latest developments?

1. Because of issue of limited land for production base, there is significant increase import of grains to meet the requirements of livestock production.

2. In view of the increasing number of commercial farms in peri-urban areas, there is a growing concern on the accumulation of animal wastes and pollutants including emerging new diseases.

3. There is a growing import of ruminant meat from major beef producing countries.

Human and Swamp Buffalo Population in China and Southeast Asia

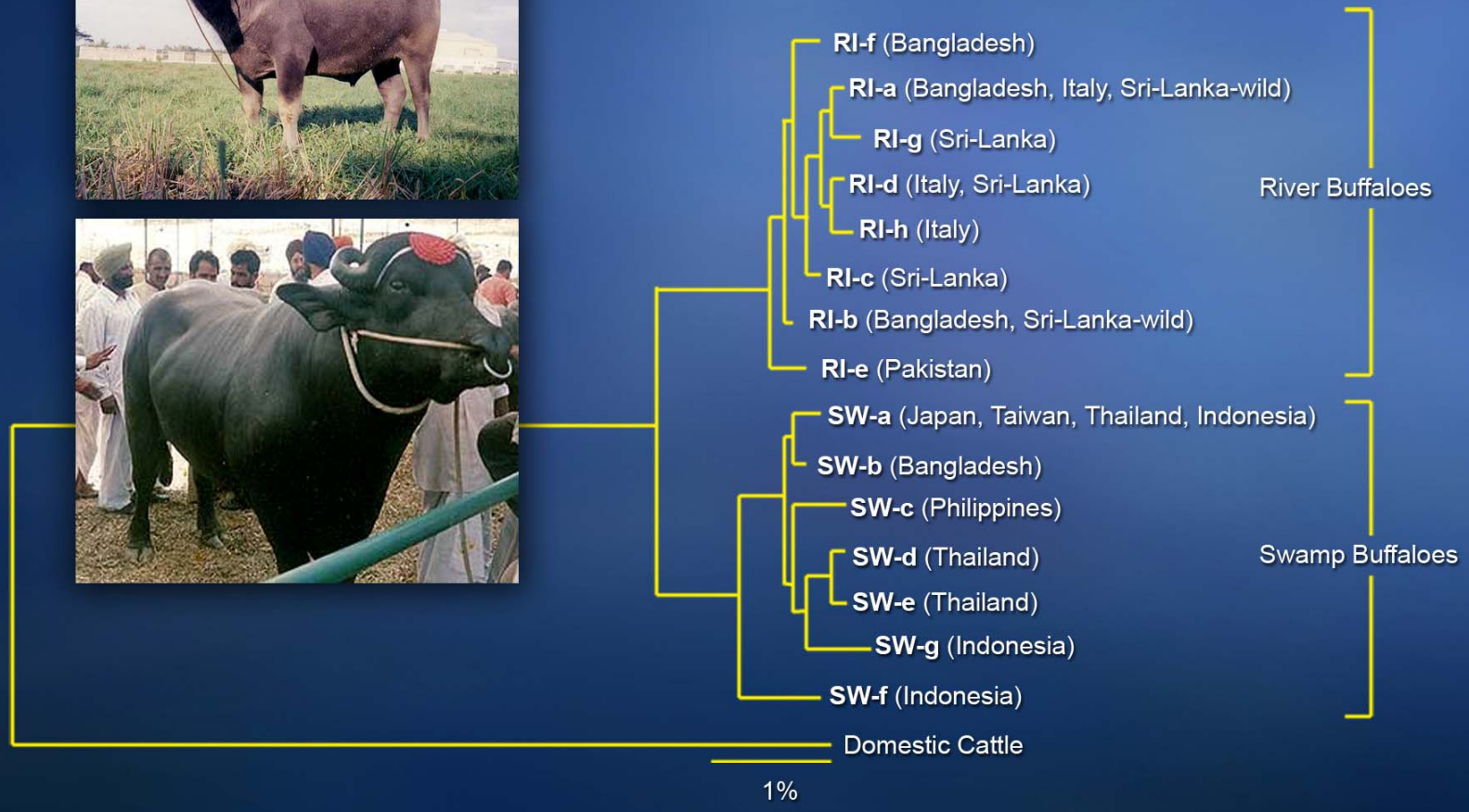
COUNTRY	2009 HUMAN POPULATION (Million)	2007 BUFFALO POPULATION (Million)	No. of POPULATION in AGRICULTURE (Million)
China	1,331.4	22,722,010	840.1
Cambodia	14.8	774,000	10.0
Indonesia	243.3	2,085,780	97.5
Lao People's Democratic Republic	6.3	1,120,000	5.2
Malaysia	28.3	130,000	3.9
Myanmar	50.0	2,841,733	34.1
Philippines	92.2	3,383,620	33.0
Thailand	67.8	1,743,546	29.9
Timor-Leste	1.1	110,000	0.8
Vietnam	87.3	2,996,400	57.8
TOTAL	**1,922.5**	**37,904,000**	**1,112.3**

Source: FAO, Production Yearbook 2007; FAOSTAT, FAO Statistics Division 2009; 2009 World Population Data Sheet

Milk and Beef Sufficiency Level of China and Selected SEA Countries

COUNTRY	MILK (M Tons)			BEEF (Thousand Tons)		
	Production	Import/ Export	% Sufficiency	Production	Import/ Export	% Sufficiency
China	41.9	1.4	96.8	6510	170	97.4
Indonesia	1.0	1.6	38.5	480	90	84.3
Malaysia	-	1.0	0.01	27	82	24.8
Philippines	-	1.1	0.01	250	140	64.2
Thailand	0.7	.07	50.0	-	-	-

Source: FAO, Food Outlook, June 2009



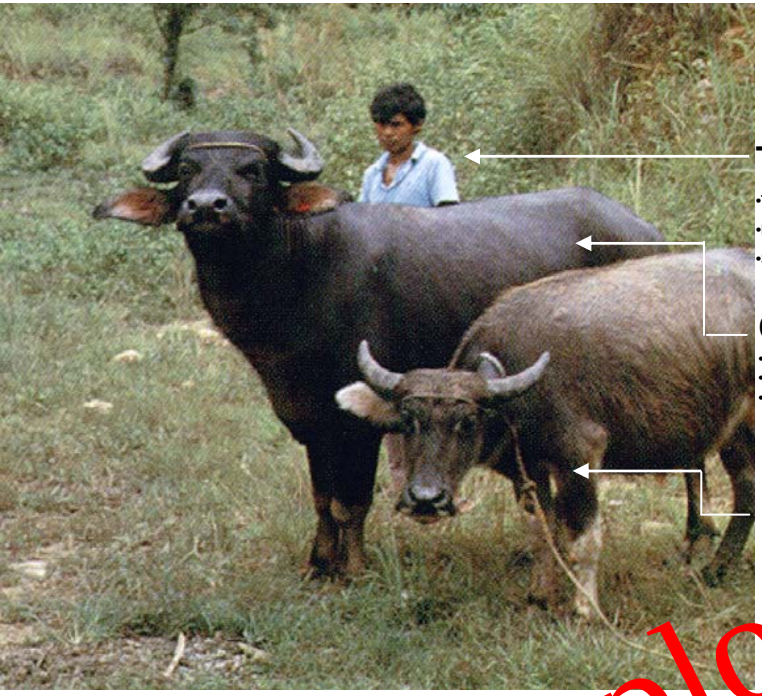
Neighbour-joining tree constructed from mitochondrial genes for cytochrome b (1140bp) for water buffaloes. The tree was constructed as described by Saitou & Nei (1987), using values estimated by the method of Kimura (1980) and it was rooted by using domestic cattle as the outgroup.

Water Buffalo Growth Rate and Tractor Usage

Country	2004 Population ('000)	% Growth Rate 1994-2004	Annual Growth Rate in Tractor Usage 1993-2002, %
East Asia			
China	22,287	-0.1	4.2
Central Asia			
Kazakhstan	9	-1.7	-
South Asia			
Cambodia	625	-2.5	12.9
Indonesia	2,572	-3.1	10.4
Laos	1,111	-1.1	-2.6
Malaysia	163	-0.4	3.4
Myanmar	2,650	2.1	-2.4
Philippines	3,270	2.0	0
Thailand	2,000	-10.1	10.4
Timor	70	3.5	1.4
Vietnam	2,869	-0.6	22.3
	15,330		
South & Southwest Asia			
Bangladesh	850	-3.0	0
Bhutan	2	0.6	-
India	97,700	1.1	4.2
Iran	560	2.4	1.9
Nepal	3,952	2.1	-0.7
Pakistan	25,500	2.9	1.3
Sri Lanka	280	-12.0	9.7
	128,844		
ASIA	166,792	0.9	
WORLD	172,263	0.9	

Source: FAO Production Yearbook, 2006

CARABAO DEVELOPMENT PROGRAM (CDP)



Typical Small hold farmer

- Tills 1 Ha of rice farm
- Earns P30,000/year
- Supports family of five

Crossbred Carabao

- Grows 2x faster
- Produce 3-4x more milk
- Good for work

Native Carabao

- Good for work
- Slow growth rate
- Poor milk production

I. GENETIC IMPROVEMENT

GENE POOL

- Riverine Buffalo
- Swamp Buffalo

UPGRADING

- Bull Loan
- Artificial Insemination

II. Buffalo Based Enterprise

- Cooperative Development
- Credit
- Market Assistance

III. Research and Development

- Technology Development
- Technical Training
- Policy

Employment Generation

Direct Job Generation

1 Purebred dairy buffalo = 1 Sustainable job

Milk=6 li/day x P40/li x 300 days/yr = 72,000
Calf = at 2 years old, P25,000/head = 25,000
P 97,000

2 Crossbred carabaos = 1 job

Milk=4 li/day x P40/li x 280 days/yr=44,800 x2 = 89,600
Calf=at 2 years old, P15,000/head=15,000 x 2= 30,000
P119,000

Indirect Jobs

Village milk collector for every 100 li of milk	1 job(100/4hrswork/day)
Milk processor for every 100 li of milk	2 jobs
Milk distribution and marketing	2 jobs

The Breeding Scheme Followed in the Philippines

(a) Swamp(**P**) x Murrah(**M**)

↓

F1 **SM** (50:50)

↓

SM x **M** (75:25)

↓

SMM x **M** (87.5:12.5)

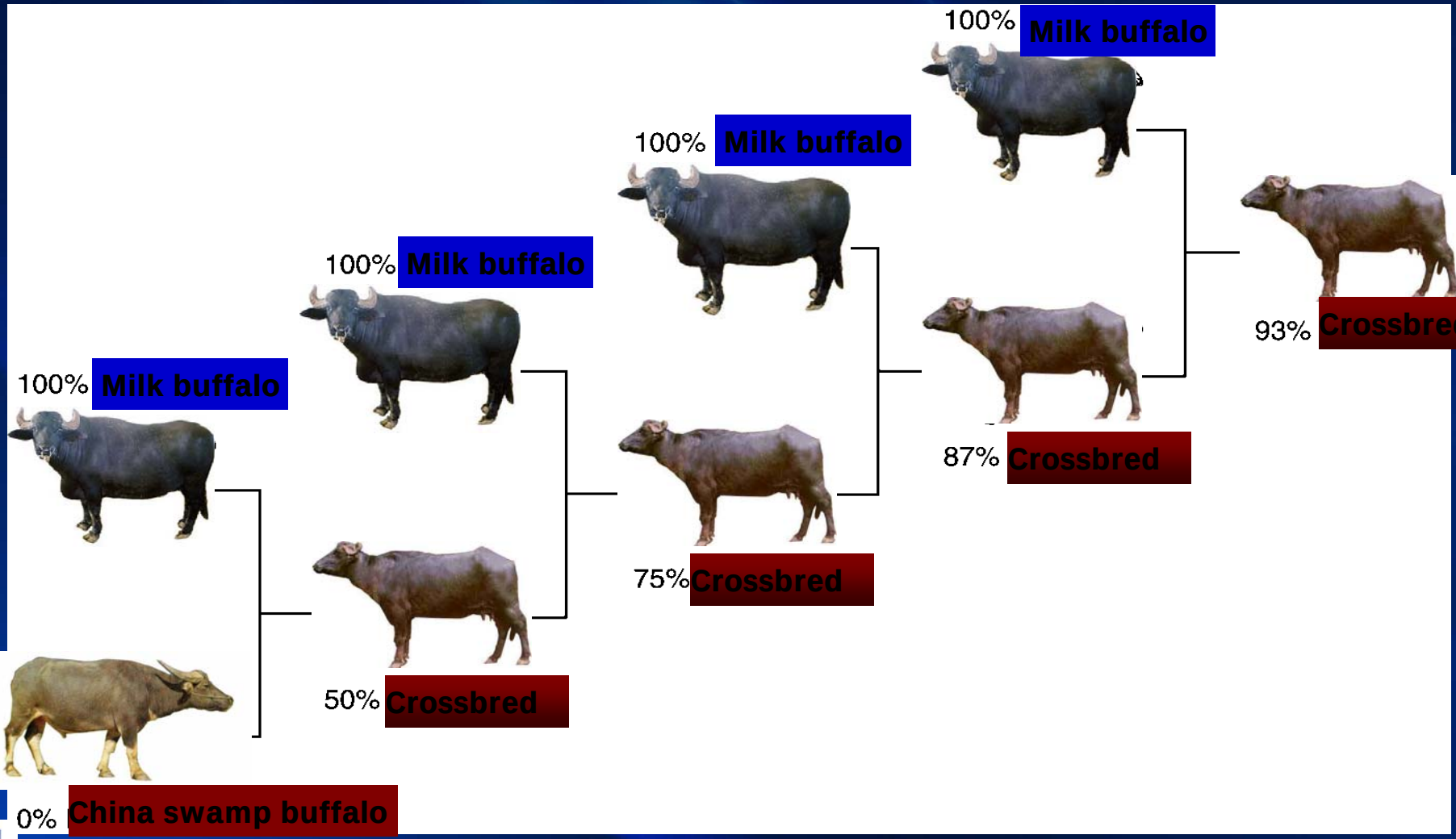
↓

SMMM x **M** (93.75:6.25)

Recent Importations of Riverine Buffalo Breeder Stocks, Philippines

YEAR	NUMBER	SOURCE	IMPORTANT TRAITS/USAGE
1994	237	USA	MEAT
1995	459	BULGARIA	MILK
1996	403	BULGARIA	MILK
1998	1656	BULGARIA	MILK
1999	605	BULGARIA	MILK

Buffalo breeding scheme



Chinese Crossbreeding and Backcrossing Involves Three Breeds, the Chinese Native Swamp Buffalo, the Indian Murrah and the Nili-Ravi from Pakistan

(a) Swamp(**P**) x Murrah(**M**)	(b) Swamp(**S**) x Nili-Ravi(**N**)	(c) Swamp(**S**) x Murrah(**M**)
F1 SM (50:50)	**F1 SN** (50:50)	↓
↓	↓	**F1 SM** (50:50)
SM x M (75:25)	**SN x N** (75:25)	↓
↓	↓	**SM x N** (50:25:25)
SMM x M (87:12.5)	**SNN x N** (87:12.5)	
↓	↓	
SMMM x M (93.75:6.25)	**SNNN x N** (93.75:6.25)	

Milk Production Parameters of Different Buffalo Pure Breeds, Crossbreds and Backcrosses

Breed	Head	Lactation	Lactation length (day) X±S CV%	Milk yield X±S(kg) CV%	Average milk yield per day (kg)	Corrected 305-day milk yield X±S(kg) CV%	Highest daily milk yield (kg)
L	70	70	280.4±20.2 7.2	1092.8±207.44 19.0	3.79		6.60
M	65	237	324.7±73.6 22.7	2132.9±578.3 27.1	6.57	2117.1±430.0 20.3	17.40
N	58	164	316.8±76.1 27.2	2262.1±663.0 29.3	7.14	2366.4±51.6 23.7	18.40
MLF_1	73	241	280.1±76.1 27.2	1233.3±529.7 42.9	4.40		16.50
MLF_2	16	54	303.2±83.1 27.4	1585.5±620.6 39.1	5.22		13.00
NLF_1	6	45	326.7±96.4 29.5	2041.2±540.9 32.4	6.25	2060.7±386.2 18.7	16.65
NLF_2	9	20	325.8±93.2 28.6	2267.6±774.8 34.2	6.96	2298.4±6044.4 26.4	18.37
NML F_2	45	168	317.6±78.4 24.7	2294.6±772.1 33.7	7.22	2348.0±533.2 22.7	18.80

Yang et al. (2004), Zhang (2006)

L = Chinese Swamp buffalo (this represent selected animals)
M = Murrah
N = Nili Ravi
MLF_1 = F_1 cross Murrah x Swamp
MLF_2= F_1 Murrah (Backcross)
NLF_1 = cross Nili Ravi x Swamp
NLF_2 = F_1 x Nili Ravi (Backcross)
$NMLF_2$ = (M x L) crossbred x Nili (triple cross)

Liveweight of Swamp Buffalo and its Crosses with Riverine Breed, kg

Breed/Type Swamp	N	Age, Year	Liveweight	Δ% [a]
Male	79	4-5	443	-
Female	92	4-5	398	-
SBxM (50:50)				
Male	11	4-5	531	19.8%
Female	19	4-5	476	14.5%
SBxM (25:75)				
Male	8	4-5	530	19.6%
Female	7	4-5	479	20.3%
SBxNili (50:50)				
Male	15	4	538	21.4%
Female	18	4	482	21.1%

Faylon, 1992, [a] Δ % increase over the swamp buffalo parents

TENDERBUFF SLAUGHTERING

PARAMETER	SWAMP	RIVER CROSSES	% DIFFERENCE OVER SWAMP
No. of Animals	52	24	
Mean HSCM (kg)	224.6	258.9	15.3%
Eye muscle area (cm^2)	57.1	70	22.6%
Mean pH	5.54	5.51	-1%
Mean carcass length (cm)	104.0	108.6	4.4%
Mean grid $/kg	$3.05	$2.96	-3%
Mean p8 fat (mm)	7.1	10.0	41%
Mean dressing %	51.2	51.7	1%
Mean price $	$686.07	$768.68	12.0%

Lempke, 2004

Mean ± SE semen characteristics of Murrah buffalo and F1 crosses, PCRDC-CLSU, January - December

PARAMETER	MB	CB
Volume, ml	2.8±0.09a (735)	2.08±0.2b (444)
Initial motility (%)	61.8±4.60a (735)	45.5±11.4b (444)
Sperm concentration (107/ml)	88.4±8.60a (710)	91.0±9.7a (300)
Prefreezing motility (%)	64.8±9.10a (581)	60.6±2.6a (151)
Postfreezing motility (%)	26.3±3.20a (636)	27.2±4.4a (260)
Incidence of ejaculation with initial motility		
Less than 50 (%)	6.7b	32.0a
Total sperm output (Vol x conc.)	253.0±23.3a	191.8±28.0b
Total quality semen (Vol. x conc. X mot.)	156.9±23.0a	98.1±17.5b

a,b Means in the same row with different superscripts differ (P<0.05); Number in parenthesis represents number of ejaculates.

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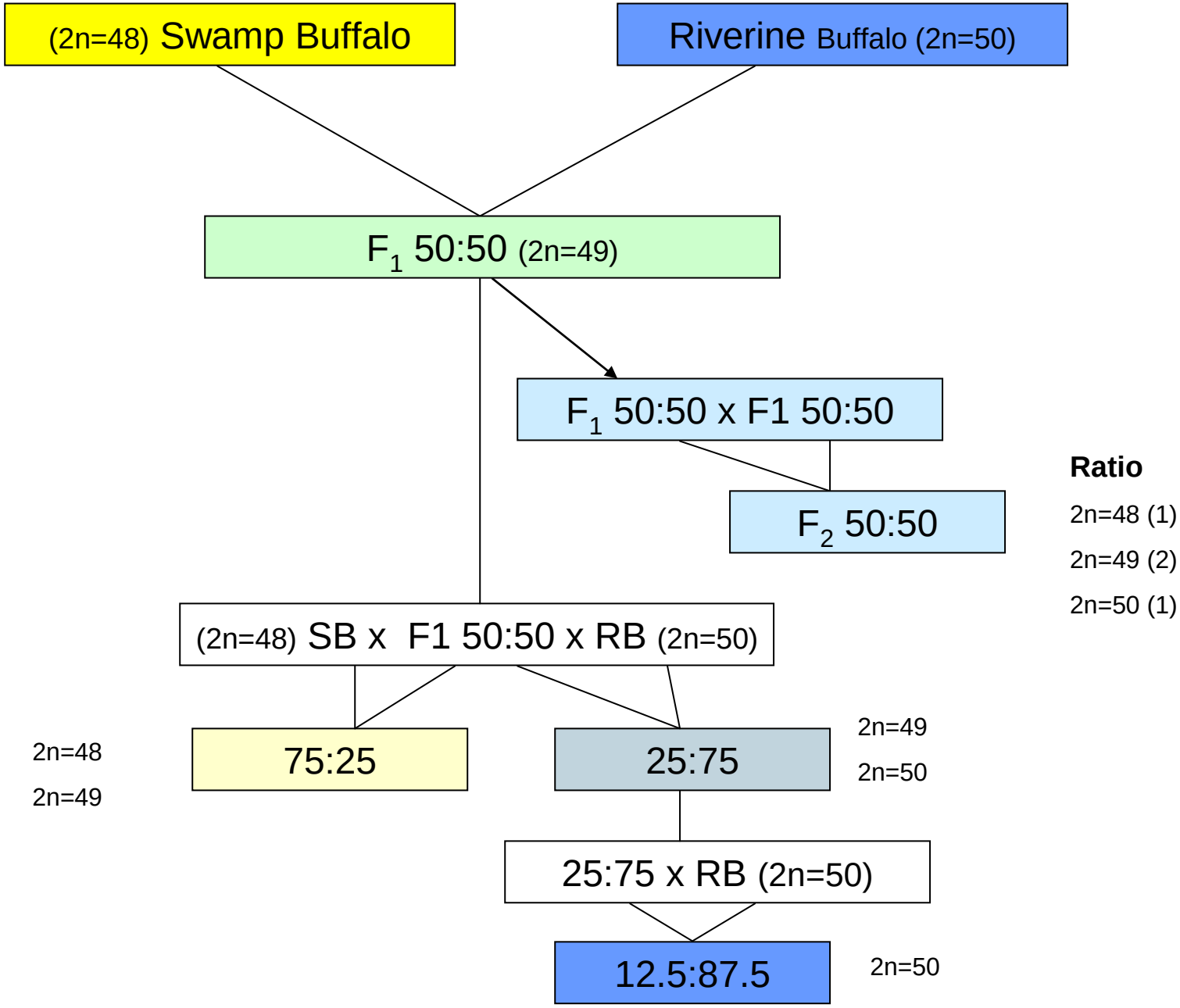

(2n=48) Swamp Buffalo
Riverine Buffalo (2n=50)
F1 50:50 (2n=49)
F1 50:50 x F1 50:50
F2 50:50
Ratio
2n=48 (1)
2n=49 (2)
2n=50 (1)
(2n=48) SB x F1 50:50 x RB (2n=50)
2n=48
2n=49
75:25
25:75
2n=49
2n=50
25:75 x RB (2n=50)
12.5:87.5
2n=50

Karyotypes of Swamp, Riverine and Crossbred Buffaloes

2n = 50 (river and ¾ river)
2n = 49 (F1, F2 and ¾ Swamp)
2n = 48 (Swamp, F2 and ¾ Swamp)

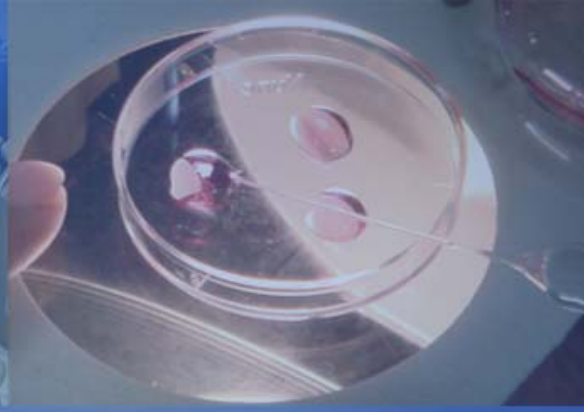
Institutionalization of NBDP

1. Establishing ground for Genetic Improvement
   a) gene pool for swamp buffaloes
   b) gene pool (elite herd) of riverine buffaloes
   c) GIP
   d) support laboratories for reproductive and DNA-based biotechniques
   e) Cryobanking

2. Utilization of Superior Germplasm
   a) AI system (semen use & distribution)
   b) Bull loan system

3. Support to buffalo-based Enterprise

4. Research & Development

Swamp Buffalo

Outstanding animal from outside the country

GENE POOL
ONH

Gene Bank

In Situ
Piat, Cagayan (250 cows)

Ex Situ
CSU, Cagayan (150 cows)

Frozen Semen (5,000 dozes)

Number of target bulls = 40
With 2 new bulls per year

Tissues/Somatic cells

Embryos

GENETIC IMPROVEMENT

- ✓ **Establish Gene Pool of Murrah (Dairy)**
- ✓ **Establish gene pool of Indigenous Water Buffalo**
- ✓ **Establish gene bank (semen, embryos, somatic cells)**

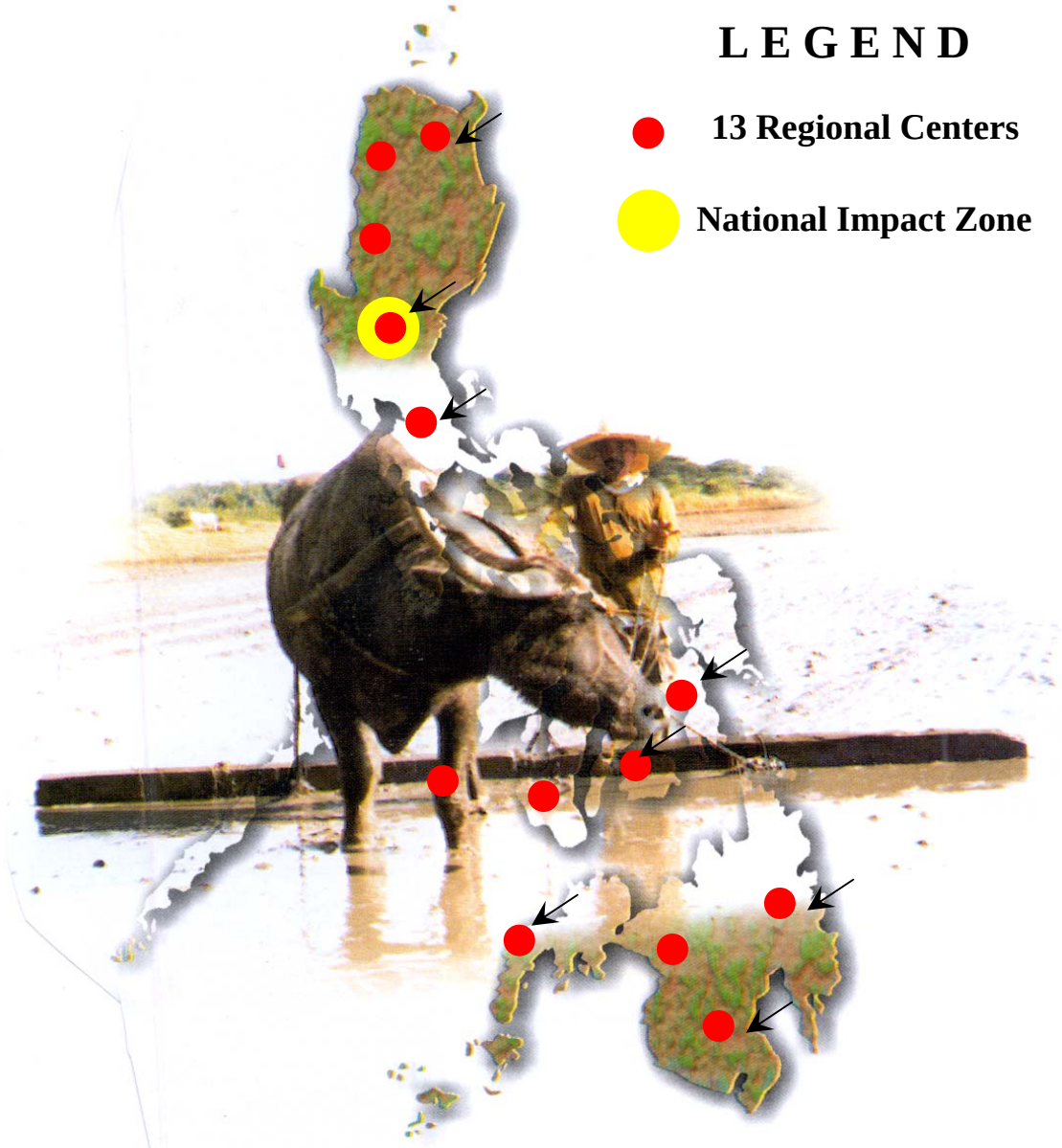
GENETIC IMPROVEMENT (Utilization)

- ✓ **Massive AI in cooperation with**
  - **- LGUs**
  - **- Village-based private technician**

  (with PCC conducting training of AI tech, processing/distribution of high genetic semen, technical assistance)

- ✓ **Massive bull loan (dairy breed bulls) in cooperation with LGUs, FAs & coops**

CARABAO DEVELOPMENT PROGRAM (CDP)



The CDP is carried out nationwide through a network of 13 PCC regional centers linking with DA RFUs and LGUs

Regional Centers:

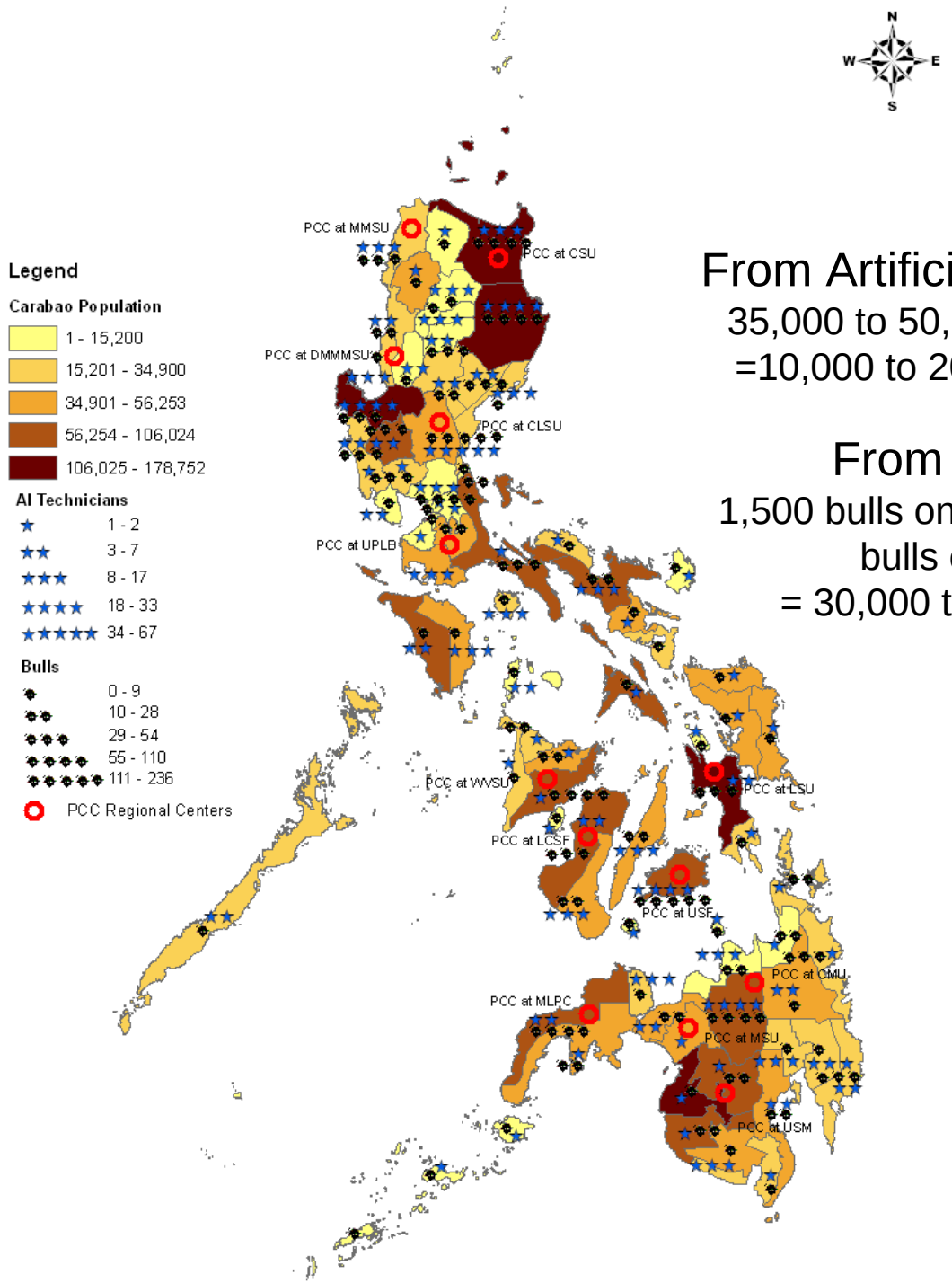
Luzon = 5

Visayas = 4

Mindanao = 4

3.36 M Total
Carabao Population

AI techs target is
2000 by 2011



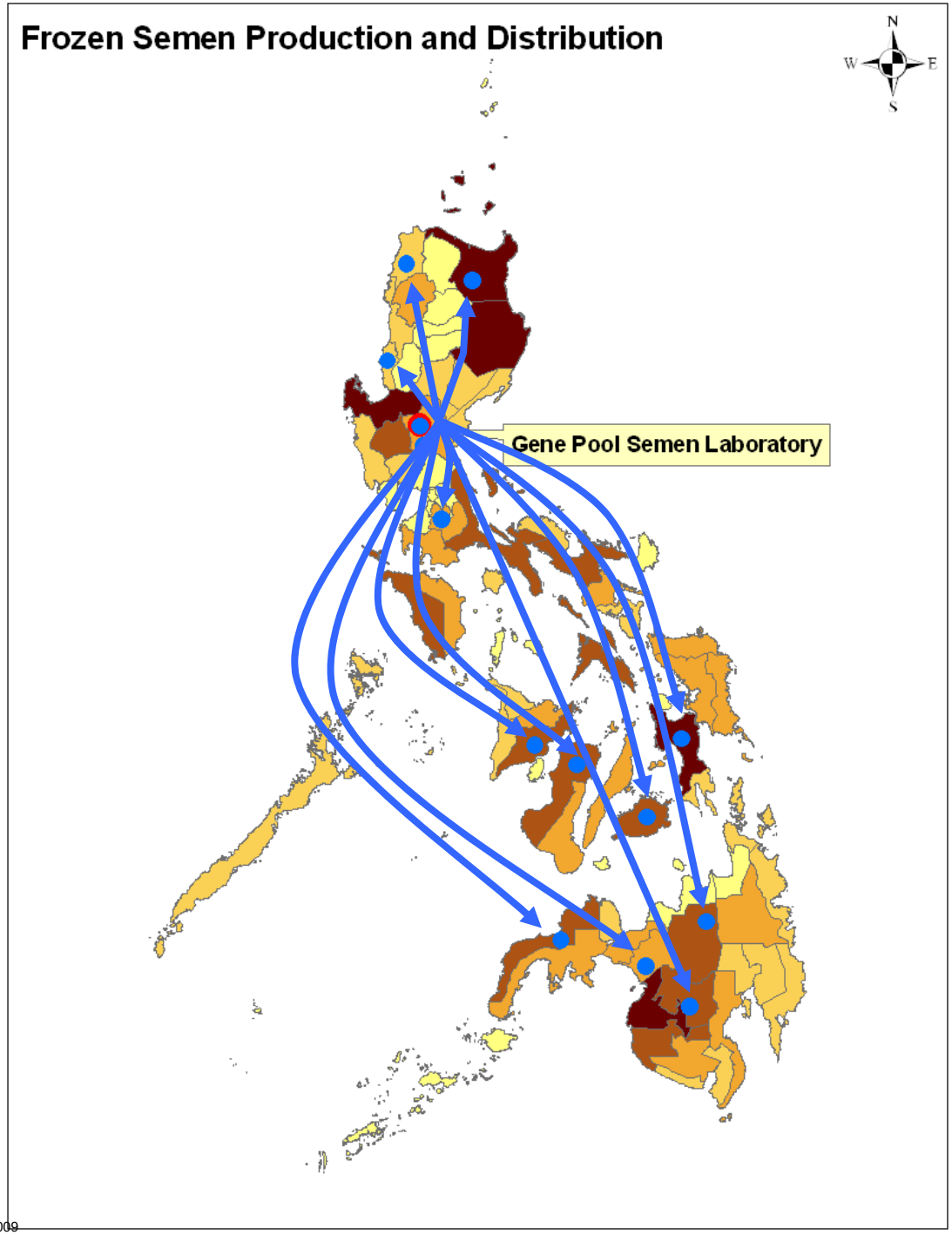
From Artificial Insemination

35,000 to 50,000 services/year
=10,000 to 20,000 crossbreds

From Bull Loan

1,500 bulls on loan and new 250 bulls every year
= 30,000 to 40,000 CB/yr

Frozen Semen Production and Distribution

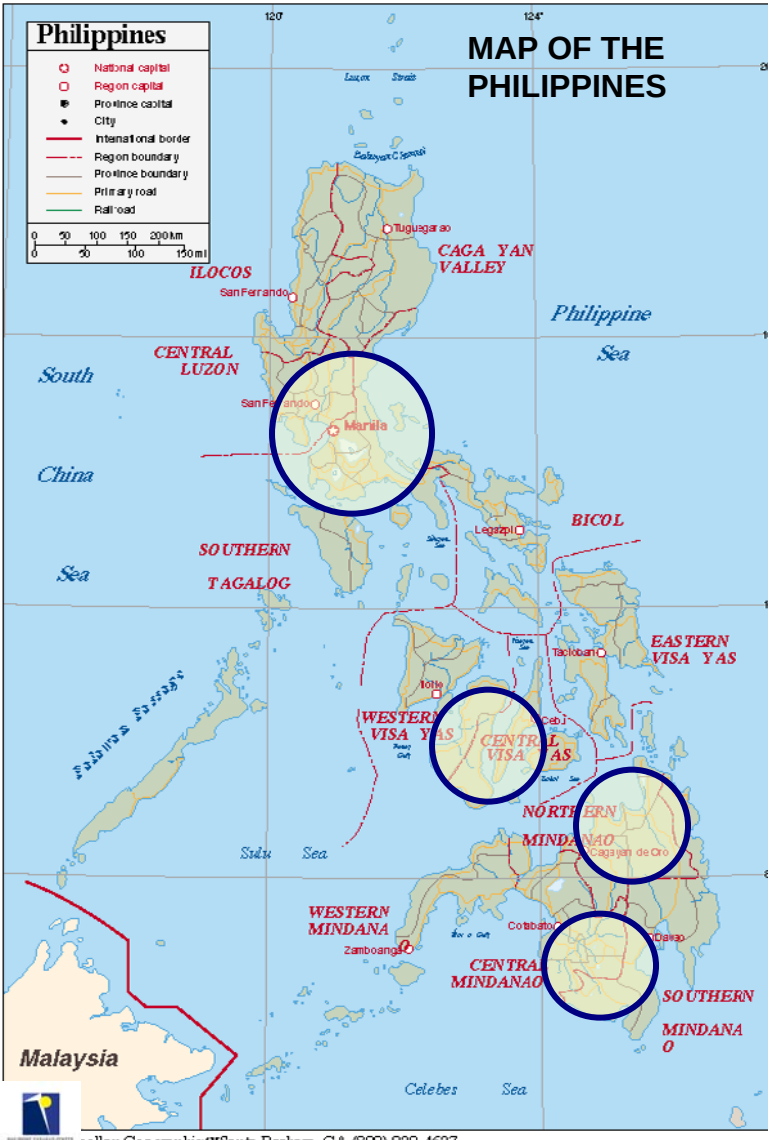



SPORTS
AAC
PUMA

beyond technologies

CREATING ENTERPRISES for SMALL HOLDERS

“Bussinessizing” the small-holder producers

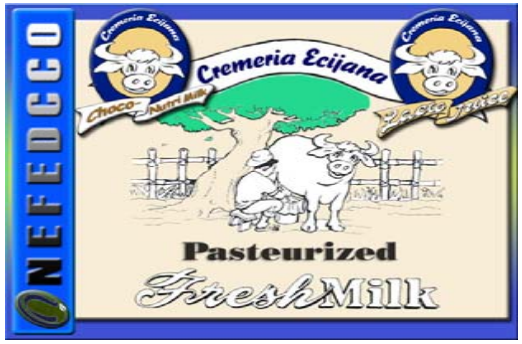


- ✓ **Establish four DAIRY/BEEF ZONES linked with the urban markets**
  - Metro Manila grid
  - Cebu grid
  - Cagayan de Oro grid
  - Davao grid

Smallholder producers coops

NEFEDCCO

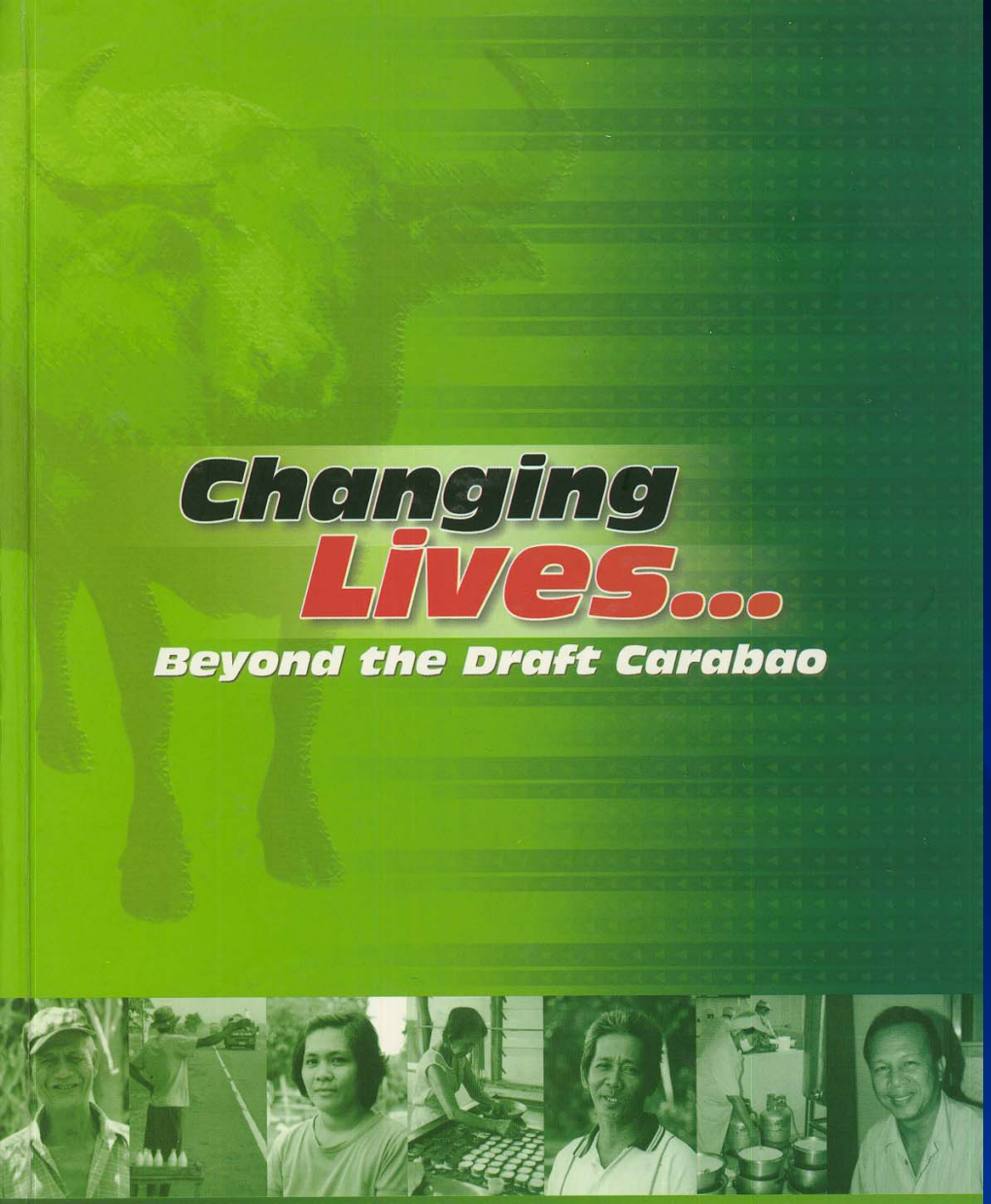
Talavera, Nueva Ecija- Philippines



Milk Products

- ✓ Pasteurized Milk
- ✓Flavored Milk
  - ➢Lacto juice
  - ➢Green Milk (Malunggay & Pandan Extract)
  - ➢Buko-Pandan
  - ➢Choco
- ✓Paneer
- ✓Pastillas de Leche
- ✓Pastillas de Ube
- ✓Kesong Puti
- ✓Raw milk


OTOP
PHILIPPINES



- Daily cash income from milk sales
  - ➢Kids to school
  - ➢Better health care
  - ➢New household appliance
  - ➢New motorcycle and jeepney
  - ➢New house renovation
  - ➢New house
- Daily access to milk by household
  - ➢Reduce malnutrition for the young
- Use of extra farm labor
- Efficient use of farm residues normally wasted
- Increase Self respect and Self Worth

Future Outlook

1. Intensive crossbreeding & backcrossing for dairy herd-build up (utilizing the large base population of swamp buffaloes)

2. Sustained genetic improvement program (assuring that selected and best animals are used generation after generation)

3. Intensified used of biotechniques for GIP (hasten GIP)

4. Social organizations and enterprise support (to ensure farmers income)

THANK YOU