

Policy guidelines and desired regulatory mechanism for bovine breeding

Kamlesh Trivedi

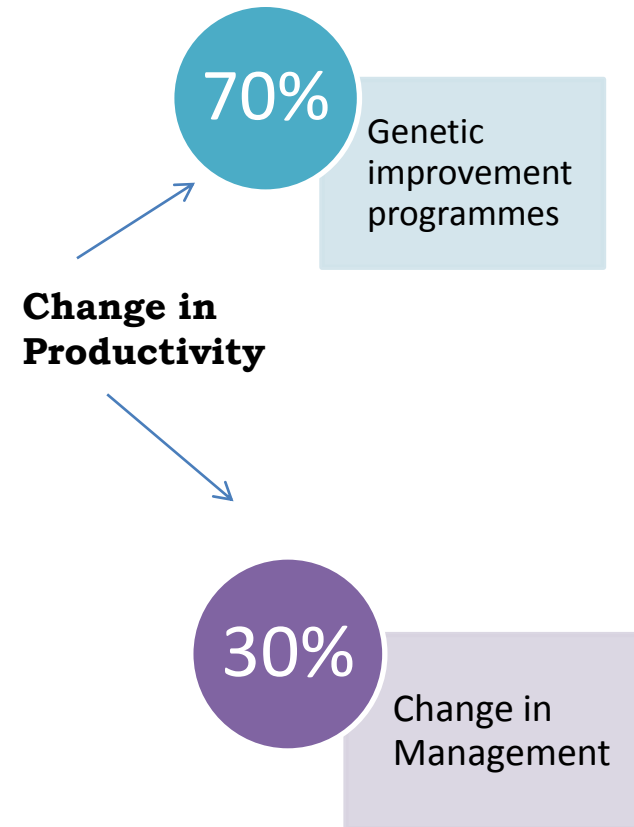
Advisor, NDDB



Contribution of Genetic Improvement Programmes

Country	1975	1985	1995	2005	2010	2012	CAGR %
Israel	5,885	7,919	8,739	9,822	10,767	11,580	1.8
USA	4,699	5,913	7,441	8,877	9,587	9,841	2.0
Canada	3,796	4,622	6,366	7,496	8,531	8,816	2.3
France	3,281	4,163	5,517	6,288	6,278	6,582	1.9
Denmark	4,492	5,684	6,656	8,123	8,640	8,529	1.7
Netherlands	4,623	5,370	6,613	7,299	7,468	7,576	1.3
Australia	2,844	3,441	4,646	5,215	5,810	5,575	1.8

Source: FAOSTAT



Main components of Breed Improvement

**Breeding policy and
Setting Breeding Goal**

➤ **Produce high genetic merit bulls through:**

- Progeny testing – in partnership with farmers
- Pedigree selection (indigenous breeds)
- ONBS – using Embryo transfer
- Genomics

➤ **Produce quality semen by:**

- Using only high genetic merit bulls free from disease
- Adhering to standards laid down
- Complying with bio-security measures

➤ **Provide quality AI service by:**

- Animal identification
- Maintaining effective LN delivery system
- Using semen from certified Semen station –as per breeding policy
- Ensuring hygiene & protocol
- Reducing number of AIs per conception
- Providing advisory services & inputs

**SET STANDARDS
EVALUATE PERIODICALLY
CERTIFY PROGRAMME**

**SET STANDARDS
EVALUATE PERIODICALLY
CERTIFY STATION**

**SET STANDARDS
REGISTER PROVIDER
EVALUATE PERIODICALLY**

Maintain a live computerised database_use information_improve productivity

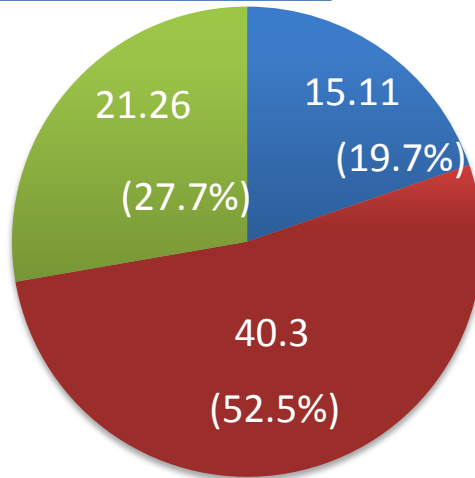
Developing appropriate breeding policy

- Dairy farmers want :
 - Animals that can be fed and managed for economically optimal production in their existing agro-climatic conditions.
 - To raise gradually genetic potential of their animals and thereby productivity of animals and their income.
- Planning efforts need to decide on:
 - What kind of animals suit best in a given area:
 - Examine existing genetic resources
 - Examine existing environment and production systems and predicted future environment
 - Evaluate benefit of developing local breeds
 - Evaluate benefits of introducing outside breeds – Indian breeds , exotic breeds, against developing local breeds – and developing them further through selective /straight breeding or crossbreeding
 - How a steady genetic progress could be achieved in the chosen breed/targeted population.
 - Decide on appropriate genetic improvement programme to develop breeds/ breed crosses
 - Plan for sustaining genetic improvement programmes

Evaluate existing genetic resources

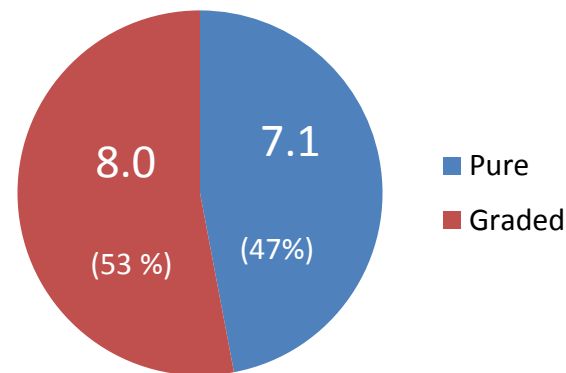
India	Cattle
Total	190.90
Females:	
Adult:	
Well-defined breeds	15.11
Non-descript	40.30
Crossbreds & Exotic	21.26
Sub-total Adults	76.69
Heifers	21.23
Young calves	25.07
Total Female cattle	122.98
Males:	
Adult:	
Well-defined breeds	9.67
Non-descript	37.07
Crossbreds & Exotic	2.13
Sub-total Adults	48.87
Local	15.20
Crossbreds & Exotic	3.84
Total Male cattle	67.91

Adult Female Cattle



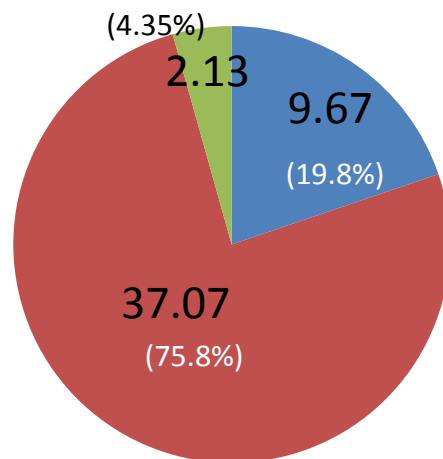
■ Well-defined breeds
■ Non-descript
■ Crossbred&Exotic

Well-defined Breed



■ Pure
■ Graded

Adult Male Cattle



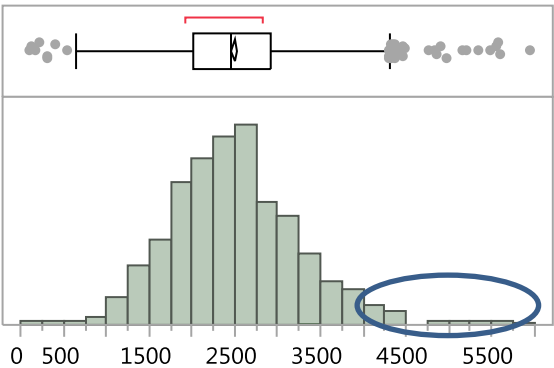
■ Well-defined breed
■ Non-descript
■ Crossbred&Exotic

Adult female population of well-defined cattle breeds

	Adult Females			Adult Males		
	Pop. In '000	% to total	% purebred	Pop. In '000	% to total	% purebred
Dairy Breeds:						
Gir	2,033	13.5	28.0	963	9.9	35.5
Sahiwal	2,088	13.8	23.3	722	7.5	21.3
Red Sindhi	210	1.4	10.6	137	1.4	13.1
Rathi	634	4.2	70.4	67	0.7	61.9
Sub total	4,965	32.9		1,889	19.5	
Dual Purpose:						
Kankrej	1,339	8.86	65.7	655	6.8	60.4
Hariana	2,668	17.7	26.1	1,283	13.3	27.9
Tharparkar	364	2.4	27.7	69	0.7	26.3
Ongole	169	1.1	16.8	283	2.9	21.5
Mewati	15	0.1	49.6	6	0.06	38.1
Krish. Velley	5	0.04	32.4	3	0.04	4.3
Deoni	110	0.7	42.8	143	1.5	42.0
Gaolao	94	0.6	39.0	140	1.5	36.9
Siri	6	0.04	68.5	4	0.04	60.8
Sub total	4,771	31.6		2,587	26.7	
Draft Breeds	5,375	35.6		5,200	53.7	
Breed Total	15,111	27.7		9,676	20.7	
Non-descript	40,306	72.7		37,067	79.3	
Total Ind.	55,417	100.0		46,743	100.0	

24 draft breeds:— 1. Nagori, 2. Kenkatha, 3. Ponwar, 4. Kherigarh, 5. Malvi, 6. Nimari, 7. Red Kandhari, 8. Khillar, 9. Dangi, 10. Amrithmal, 11. Hallikar, 12. M Gidda, 13. Kangayam, 14. Bargur, 15. Umblachery, 16. Pulikulam, 17. Bachur, 18. Panganur, 19. Kosali, 20. Vechur, 21. Ghumusari, 22. Binjiarpuri, 23. Khariar, 24. Motu.

Gir cows and their performance



Summary Statistics

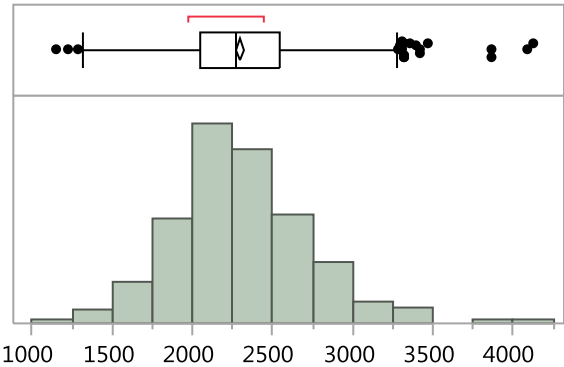
Mean	2493
Std Dev	727
Std Err Mean	15.3
N	2249

About 3.7% crossed 4000 litres

About 8% crossed 3500 litres

Lactation No	No. of Observat ions	Mean	SD
1	590	2441	709
2	647	2570	764
3	581	2483	676
4	284	2498	764
5	101	2432	730
6	31	2279	810
7	9	2178	649

Sahiwal



Summary Statistics

Mean	2300
Std Dev	400
Std Err Mean	12.0
No. of observations	1106

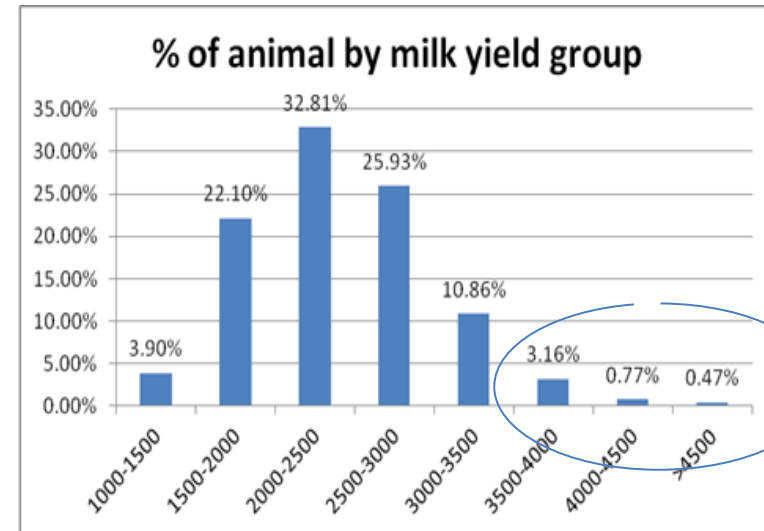
About 0.5% crossed 3500 litres
About 5% crossed 3000 litres

Lactation No	No. of observations	305 Day Yield	SD
1	257	2218	386
2	343	2260	394
3	299	2364	386
4	129	2374	421
5	56	2419	432
6	13	2186	365
7	8	2469	405

Kankrej



Lactation yields



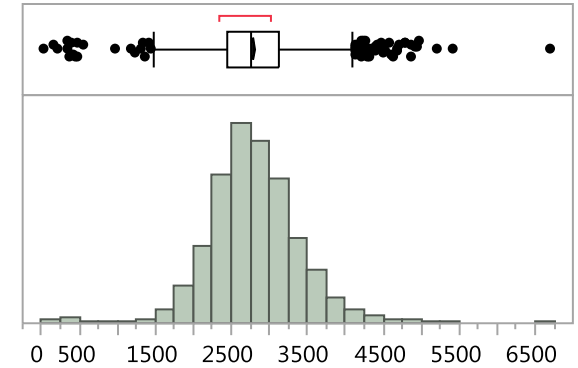
Mean	2413
Std Dev	608
Std Err Mean	9.4
N	4135

About 1.24% crossed 4000 litres

About 4.4% crossed 3500 litres

Lactation No.	Observations	305-day Yield kgs.
1	921	2264
2	830	2381
3	900	2470
4	1416	2485

Rathi

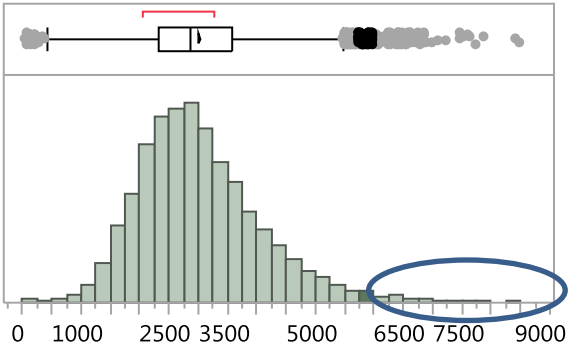


Mean	2799
Std Dev	567
Std Err Mean	10.7
No. of observations	2759

2.8% crossed 4000 litres
11% crossed 3500 litres

Lactation No.	No. of observations	Mean	SD
1	844	2683	560.1
2	814	2839	524.8
3	629	2877	578.9
4	297	2821	602.4
5	114	2826	595.0
6	42	2844	546.4
7	10	3053	674.0
8	4	2959	1198.1
10	3	2671	705.9
11	1	3084	

Holstein Friesian Crossbreds



Summary Statistics

Mean	3008
Std Dev	1007
Std Err Mean	8.2
N	14985

About 1% crossed 6000 ltrs
About 4% crossed 5000 ltrs



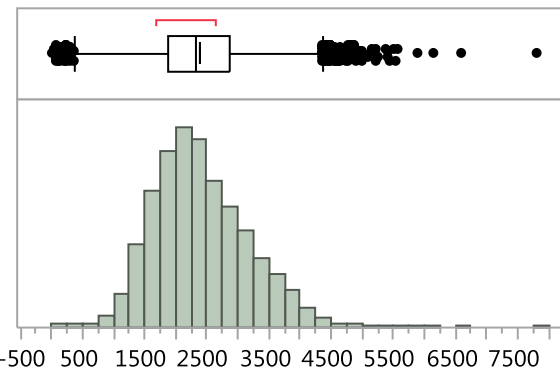
Elite crossbred animal at Surat
Cow – 340017667282, Best Lact. Yield : 8413 Kg

Elite crossbred animal at Surat
Cow – 340048825005, First Lact. Yield : 4557 Kg

Lactation No	No. of observations	Mean 305Day Yield	SD
1	9339	2831	882
2	2473	3292	1091
3	1773	3320	1139
4	868	3261	1124
5	347	3361	1272
6	123	3376	1249
7	42	3178	1089



TCMPF Jersey Crossbred Project



Summary Statistics

Mean	2392
Std Dev	735
Std Err Mean	4.2
No. of observations	29468

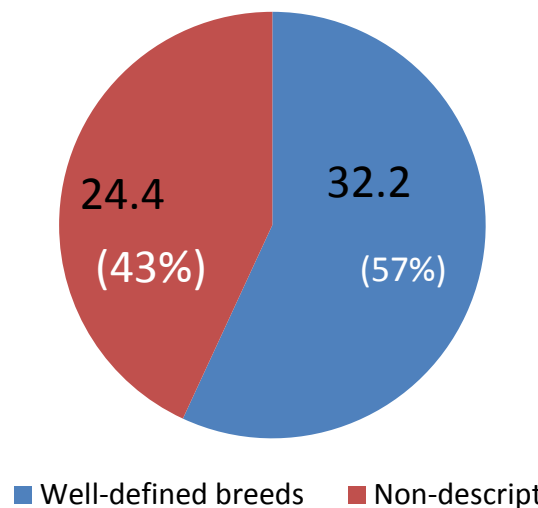
About 3% above 4000 litres
About 8% above 3500 litres

Lactation No	No. of observations	Mean 305Day yield	SD
1	10833	2234	686
2	6256	2446	738
3	5962	2494	747
4	3755	2532	748
5	1733	2508	767
6	606	2470	763
7	213	2419	749
8	74	2427	808
9	21	2281	538
10	13	2062	887

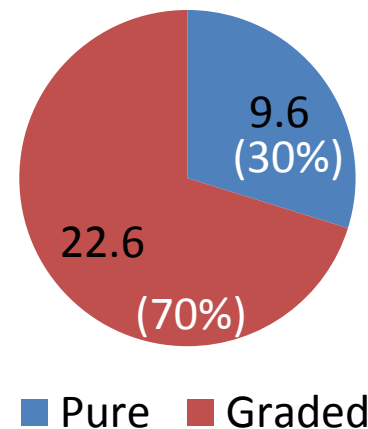
India	Buffaloes
Total Buffaloes	108.70
Adult Females	
Well-defined breeds	32.17
Non-descript	24.42
Total Adult	56.59
Heifers	15.86
Young Females	20.16
Total Females	92.60
Adult Males:	
Well-defined breeds	2.07
Non-descript	3.22
Young males	10.81
Total males	16.10

Adult Female Buffalo Population in Million

Total Buffalo -56.6 million



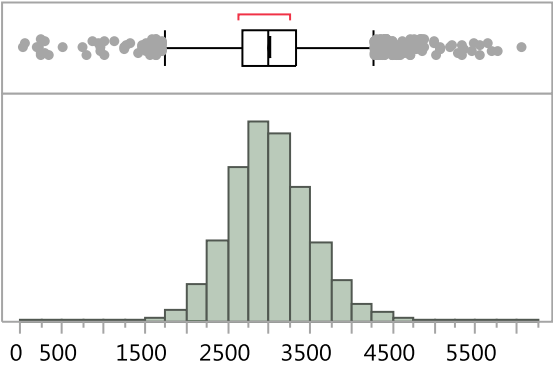
Population of Well-defined breeds - 32.2 million



Adult female population of well-defined buffalo breeds

	Adult Females			Adult Males		
	Pop. In '000	% to total	% of purebred	Pop. In '000	% to total	% of purebred
Buffalo Breeds:						
Murrah	24,928	77.5	23.6	1680	81.0	20.8
Mehsana	2,002	6.2	73.4	50	2.4	75.9
Surti	2,054	6.4	46.6	109	5.3	45.0
Jaffarabadi	1,038	3.2	31.8	33	1.6	38.0
Banni	215	0.7	62.8	9	0.4	56.7
Pandharpuri	291	0.9	59.5	7	0.3	57.4
Nagpuri	107	0.3	39.6	11	0.6	24.8
Bhadawari	892	2.8	32.6	92	4.5	38.5
Nili Ravi	370	1.2	19.2	19	0.9	23.3
Toda	2	0.01	59.4	0	0	71.0
Chilka	1.5	0.0	75.1	0	0	92.0
Kalahandi	45	0.1	79.1	58	2.8	84.3
Marathwadi	217	0.7	73.3	3	0.2	73.0
	32,166	100	29.8	2074	100	34.0
Breed Total	32,166	56.8		2,074	39.1	
Non-descript	24,420	43.2		3,224	60.9	
Total	56,586	100.		5,298	100.	

Murrah buffaloes under HLDB PT Project



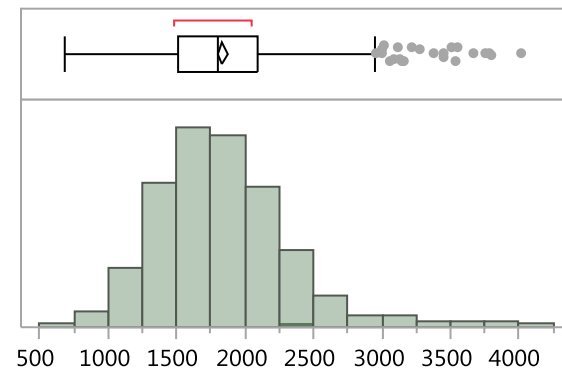
Summary Statistics

Mean	3012
Std Dev	503.3
Std Err Mean	4.3
N	13417

About 3.2% crossed 4000 litres
About 15.3% crossed 3500 litres

Lactation No.	No. of obsevation	305Day Yield	SD
1	3045	2772	427
2	4086	3012	474
3	3789	3105	505
4	1839	3162	518
5	507	3151	535
6	104	3215	635
7	32	3137	648

Mehsana Buffaloes



Summary Statistics

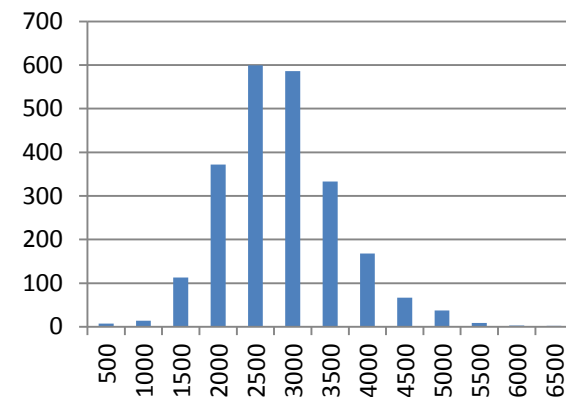
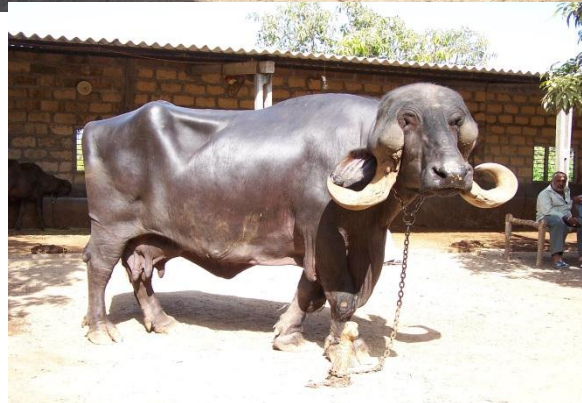
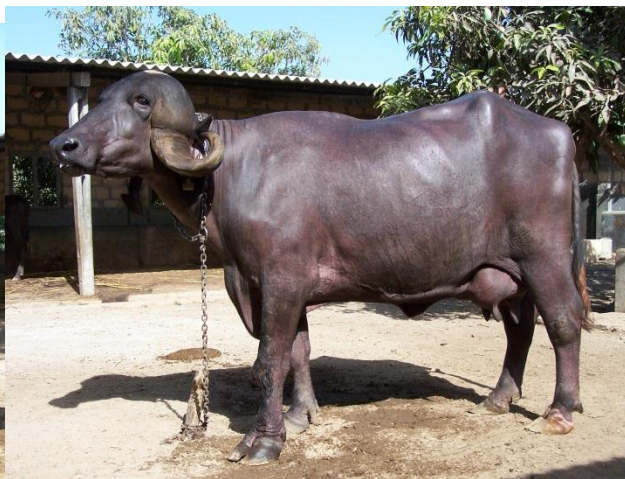
Mean	1834
Std Dev	481
Std Err Mean	16.9
No of observations	810

About 0.12% crossed 3500 litres
About 4% crossed 3000litres

Unlike other projects, here data are of daughters and not of elite animals

Lactation No.	No. of observations	305Day Yield	SD
1	766	1799	423
2	26	2119	838
3	12	2720	717
4	6	3252	766

SAG Jaffrabadi PS Project



Summary Statistics

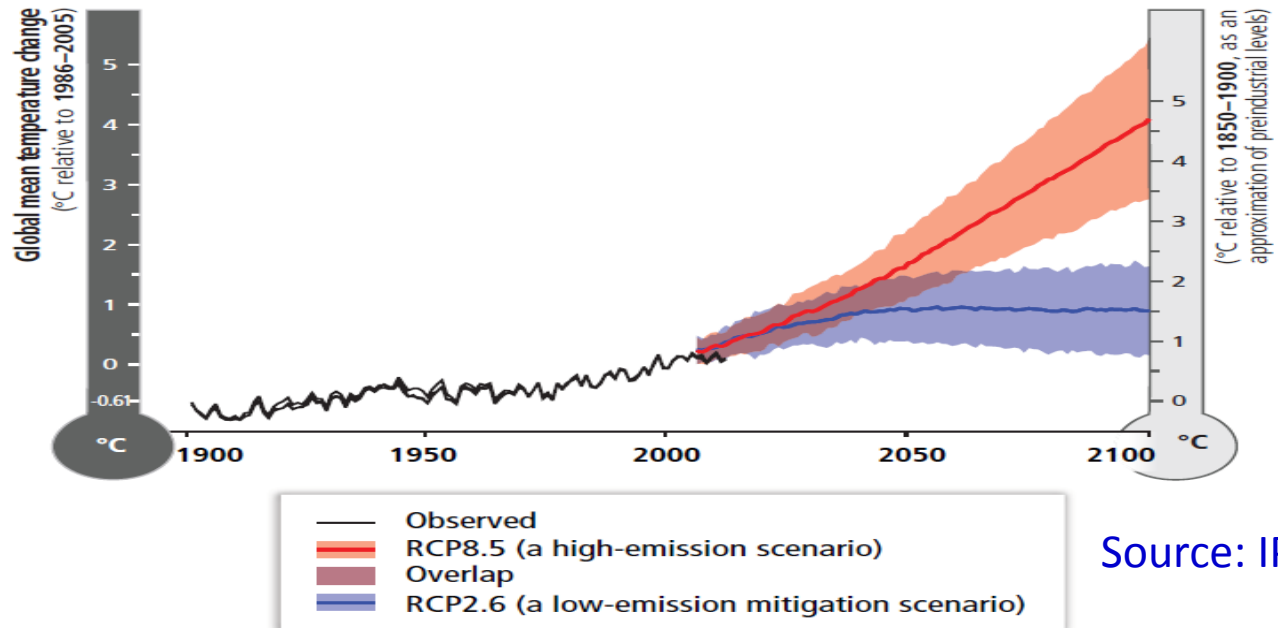
Mean	2880
Std Dev	789
No. of observations	2310

5.1% animals
produced >4500 Kg
milk

25% animals
produced >3500 Kg
Milk

Existing and Predicted Environment

Rise in temperatures



Source: IPCC, 2014

- Increase between averages of 1850-1900 period and 2003-2012 is 0.78°C [0.72 to 0.85]
- Increase between periods from 1850-1900 to 1986-2005 is 0.61°C [0.55 to 0.67]
- Global mean surface temperature for 2016-2035 (short term) relative to 1986-2005 will likely to be between 0.3 to 0.7°C and for the period 2081-2100 (long term) relative to 1986-2005 will likely to be between 0.3°C to 1.7°C for RCP2.6 and 2.6°C to 4.8°C for RCP8.5
- Heat extreme land area: With 1.5°C – 15%, 2°C 20% and 4°C – 60 to 80% land area

Uncertain rainfall

- In Indian subcontinent South Asian monsoon rainfall has declined since 1950, but increased in frequency of most extreme precipitation
- Annual precipitation likely to increase by up to 30% in a 4°C increase scenario
- Rainfall distribution is likely to be amplified: up to 30% increase during wet season, decrease up to 30% in dry season
- Globally wet regions will likely to be more wet and dry regions more dry

More extreme events – increase
frequency of draughts



More extreme events – more floods



More extreme events –

Increase spread of heat waves and
Cold winter extreme



Decide on suitability of breeds
based on existing genetic resources
and existing and predicted
environment

Approach to decide Breeding Strategies in different regions of the country

	Target base breed	Harsh Environment*		Favourable Environment**	
		Farmers with Poor Resources	Farmers with Good Resources	Farmers with Poor Resources	Farmers with Good Resources
Cattle	Well-defined indigenous breeds	Selective breeding within breed	Selective breeding within breed	Selective breeding within breed	Selective breeding within breed
	Non-descript	Upgrading with Local or Outside Indigenous breed	Upgrading with Local or Outside Indigenous breed or $CB \leq 50$	Upgrading with Local or Outside Indigenous breed or $CB=50$	$CB=50$
	Crossbreds	$CB < 50$	$CB=50$	$CB=50$	$CB > 50$
Buffalo	Well-defined indigenous breeds	Selective breeding within breed	Selective breeding within breed	Selective breeding within breed	Selective breeding within breed
	Non-descript	Upgrading with Local or outside breed – Murrah or Mehsana	Upgrading with Local or outside breed – Murrah or Mehsana	Upgrading with Local or outside breed - Murrah or Mehsana	Upgrading with Local or outside breed -Murrah or Mehsana

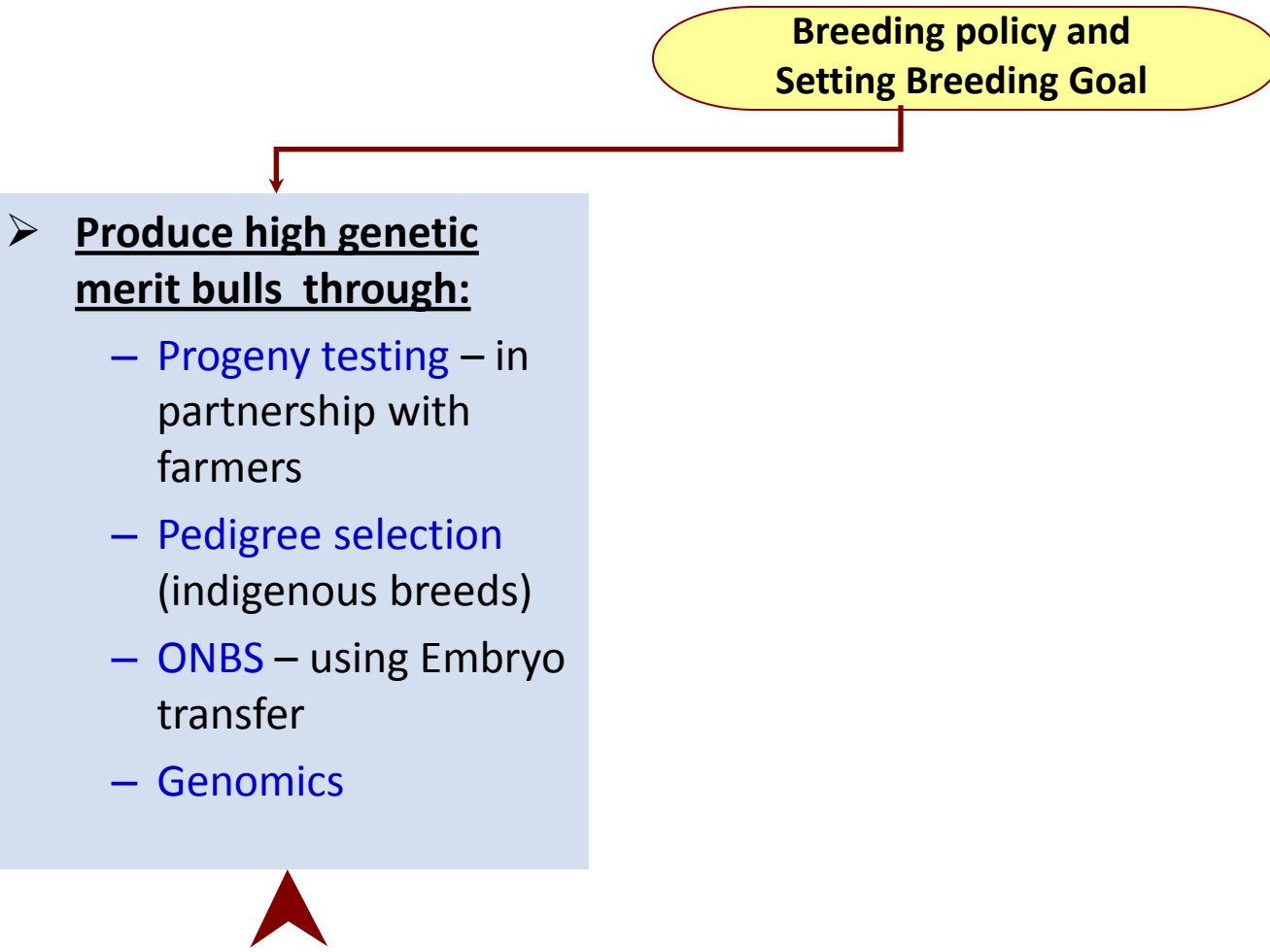
* Harsh Environment: Poor vegetation, low rainfall and high temperature-Humidity Index (> 90)

** Favorable climate: Good vegetation, medium to good rainfall, moderate Temperature-Humidity Index (< 90)

How to bring about further genetic
improvement of selected breed

Main components of Breed Improvement

Breeding policy and
Setting Breeding Goal

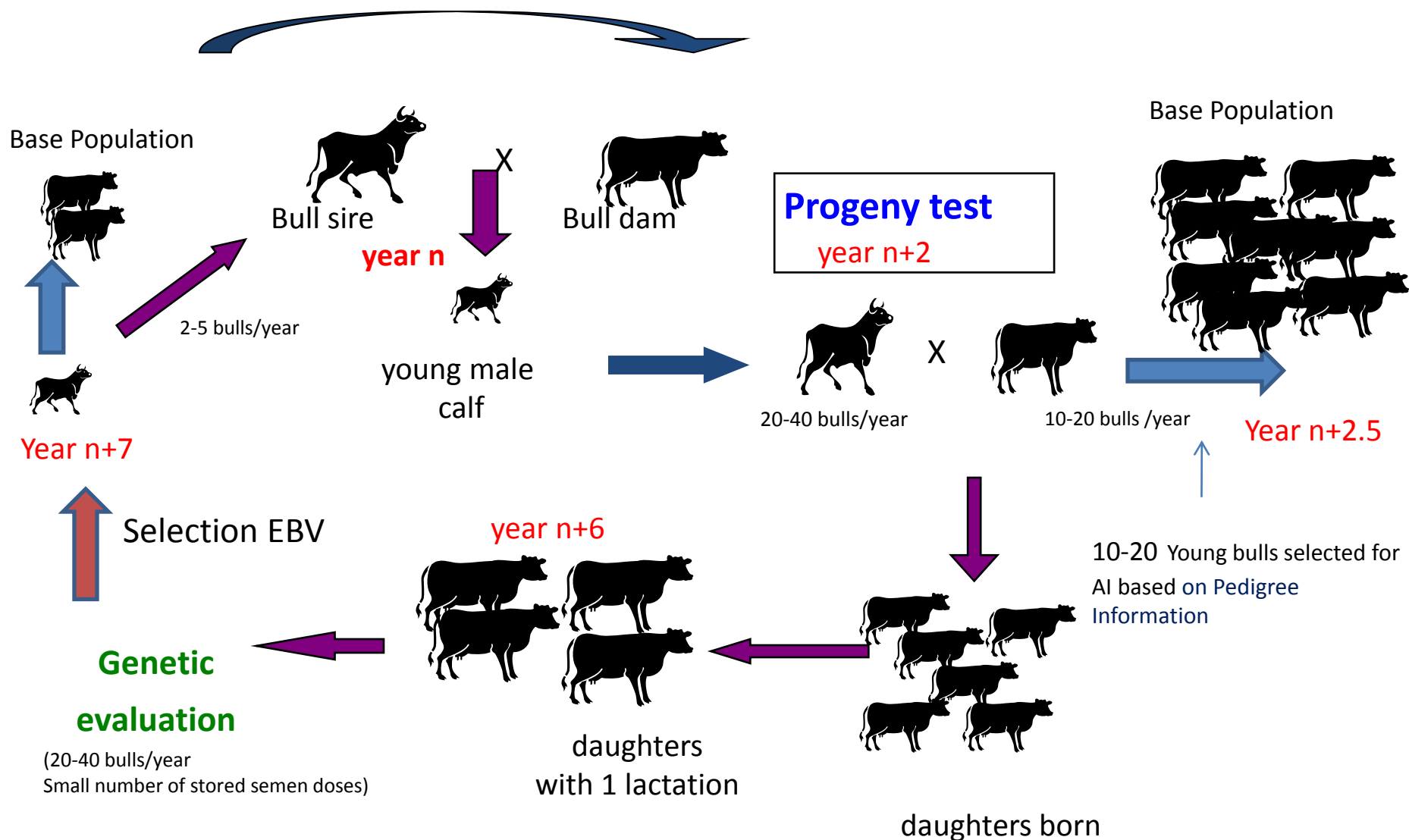


➤ **Produce high genetic merit bulls through:**

- Progeny testing – in partnership with farmers
- Pedigree selection (indigenous breeds)
- ONBS – using Embryo transfer
- Genomics

Progeny Testing

Progeny testing scheme – Young Sire Model



PT Programmes under NDP

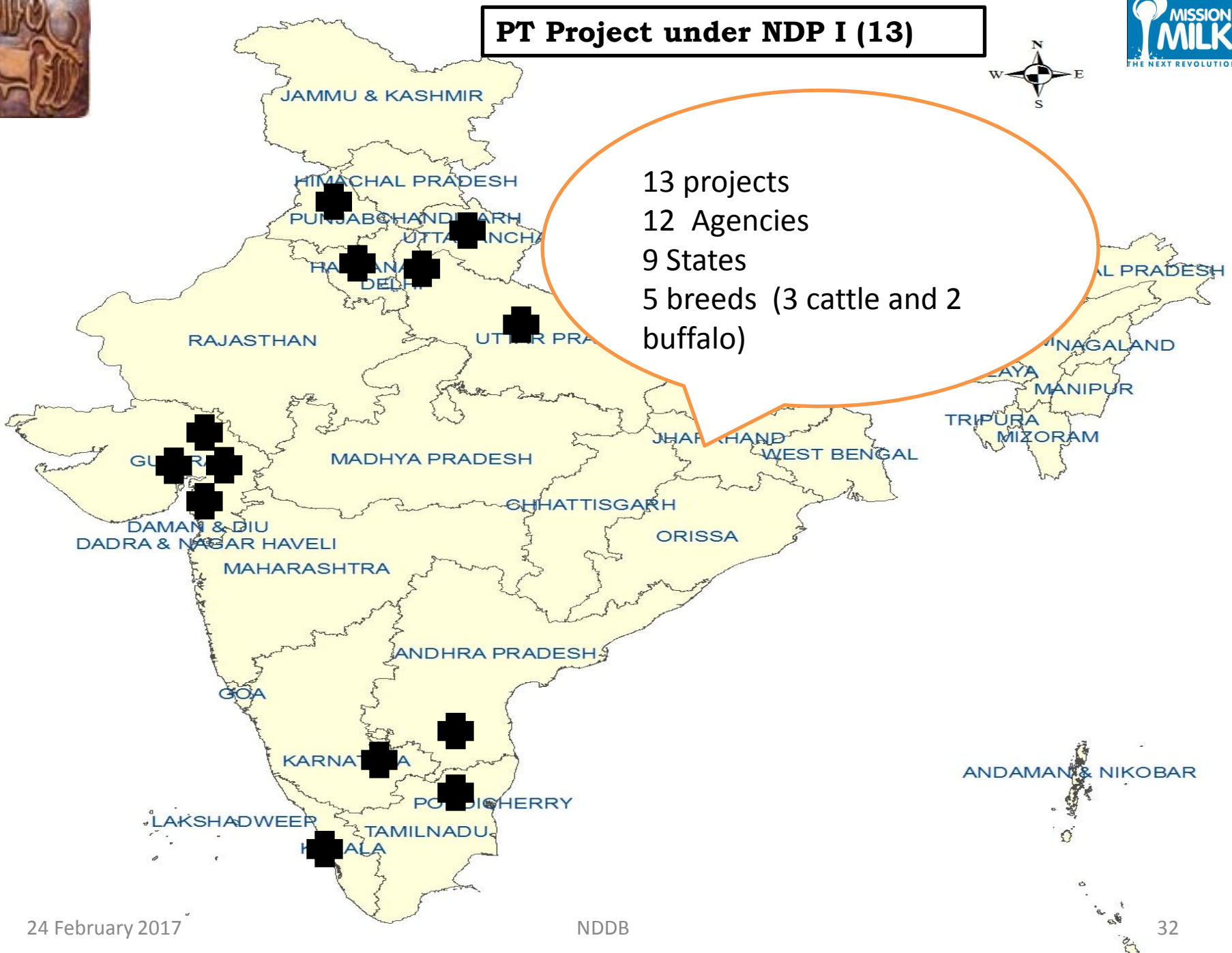
Breeds	Breed	EIAs	State
	HF	KMF	Karnataka
	HF CB	SAG	Gujarat
		ULDB	Uttarakhand
		BAIF	Uttar Pradesh
		KLDB	Kerala
	Jersey CB	TCMPF	Tamil Nadu
		APLDA	Andhra Pradesh
	Mehsana	Mehsana Union	Gujarat
		Banas Union	Gujarat
	Murrah	ABRO	Uttar Pradesh
		HLDB	Haryana
		PLDB	Punjab
		SAG	Gujarat

24 February 2017

NDDB

These five breeds would meet 87% of the total requirement of semen doses in 2016-17

PT Project under NDP I (13)



Progress of PT Projects on different parameters

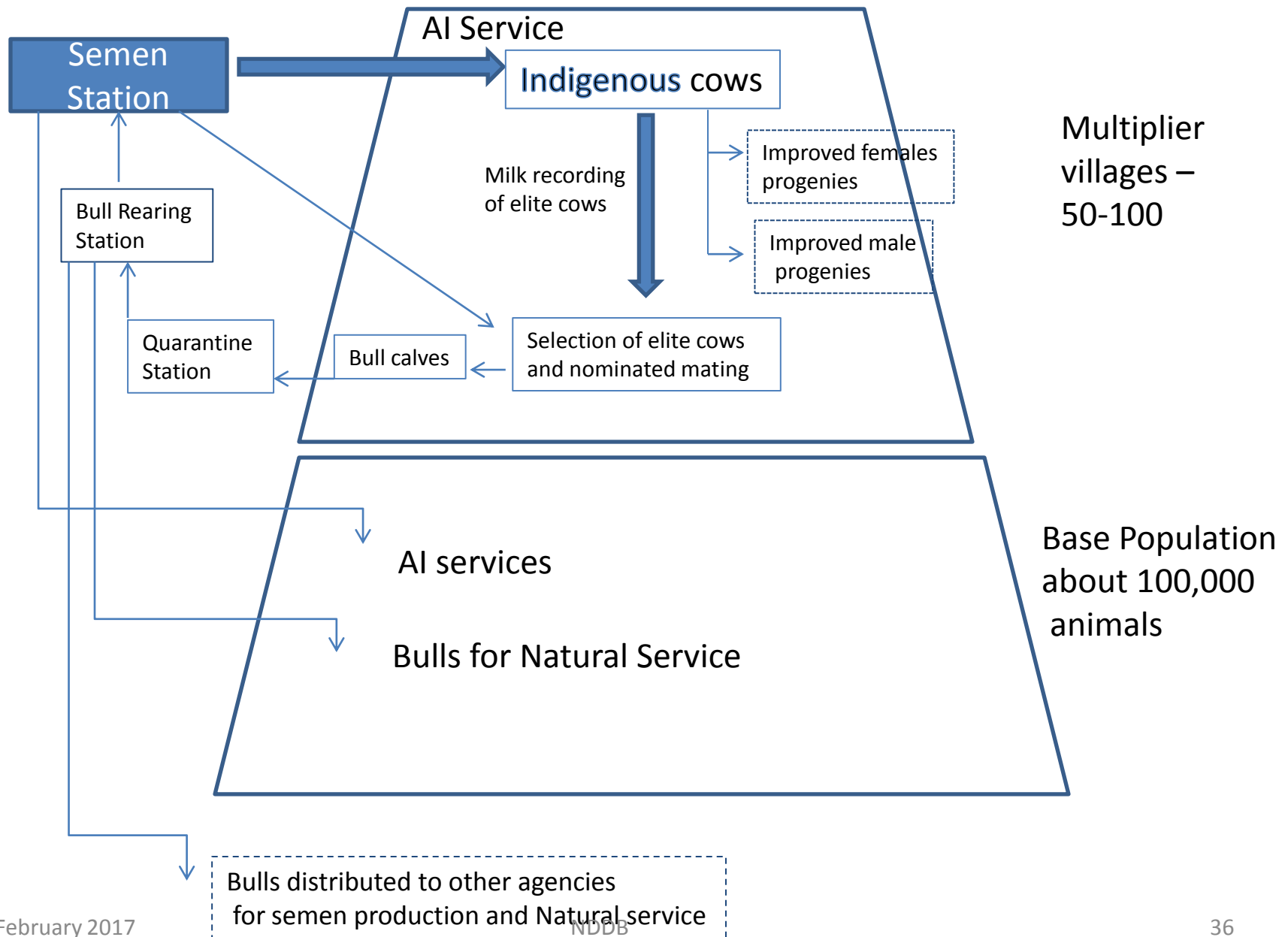
	Bulls completed test mating	Bulls under test	Test AI Done	Daughters Registered	Daughters Calved	Daughters Put to Milk Recording	Daughters Completed Milk Recording	Dams completed recording	Bulls Distributed
ABRO PT	40	35	139009	6381	0	0	0	1554	35
HLDB PT	7	43	151875	5861	0	0	0	9225	0
PLDB PT	61	30	176705	11758	1	0	0	4017	0
SAG PT Murrah	39	25	194982	29397	2726	2275	1447	3903	81
SAG HFCB	66	26	330130	46123	7171	6231	3625	7120	208
KMF PT	80	30	240356	22933	4415	3312	1411	3645	119
TCMPF JYCB	175	60	462299	45462	3340	3050	1086	20123	70
APLDA PT	20	25	143787	12120	34	28	0	1827	26
ULDB PT	10	21	65569	4389	0	0	0	792	0
BAIF HFCB	15	25	64204	5457	0	0	0	2582	0
Banas PT	29	15	92754	11809	1153	832	604	3137	29
Mahesana PT	20	23	138186	10693	2192	1931	1305	3560	26
KLDB PT		20	46652	2961	0	0	0	832	0
Total	562	378	2246508	215344	21032	17659	9478	62317	594

Challenges faced in implementing PT projects

- In some programmes scale of operation is small; scope of expansion is limited
- Small herds - difficult to identify contemporary groups
- Developing infrastructure for measurement of traits in widely dispersed herds
- Convincing farmers to participate in animal identification and recording programmes
- Sustaining PT programmes

Pedigree Selection

Breeding Design






PS Programmes for production of HGM bulls of different breeds

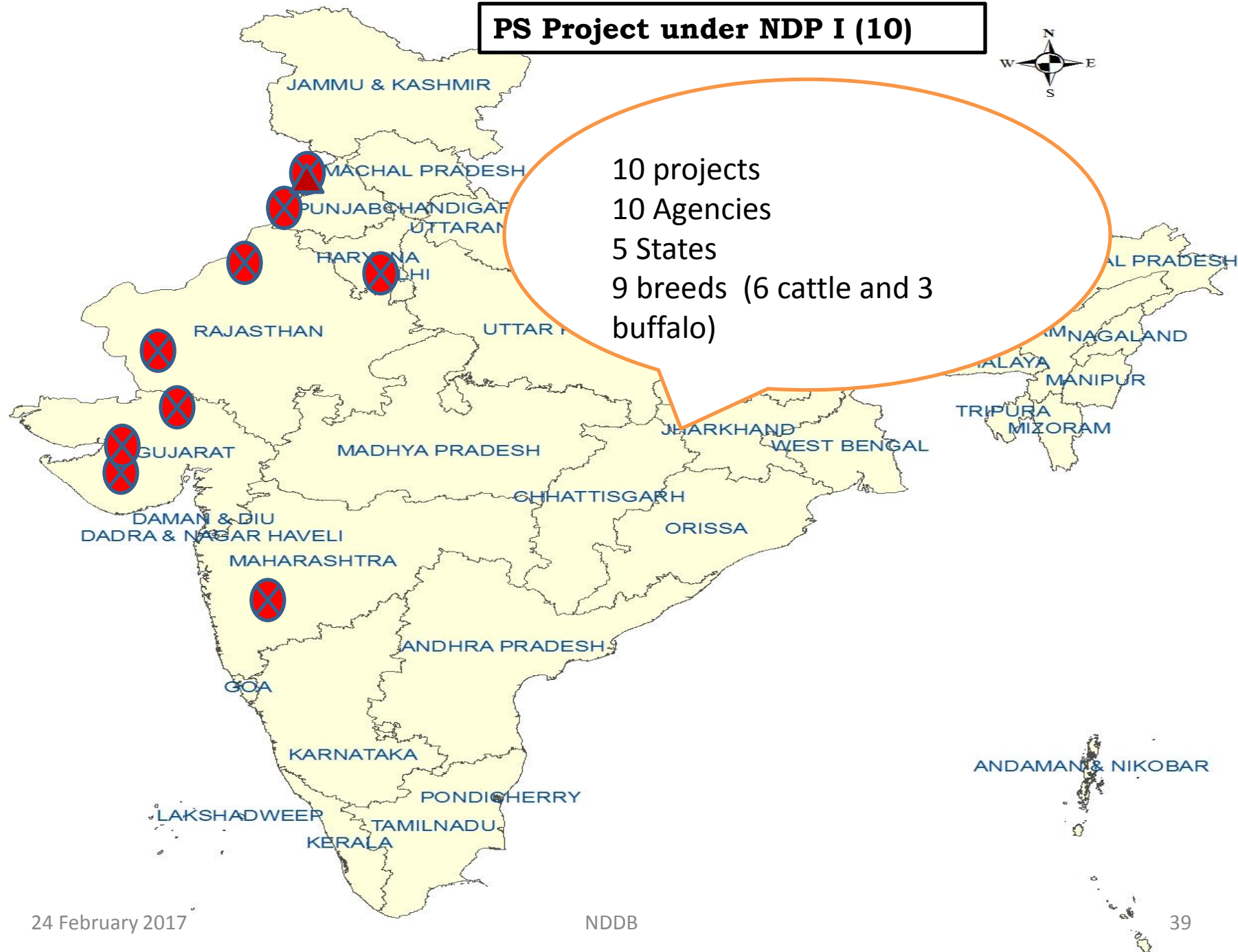
Breeds	Breed	EIAs	State
	Rathi	URMUL	Rajasthan
	Kankrej	Banas	Gujarat
	Gir	SAG	Gujarat
	Jaffrabadi	SAG	Gujarat
	Hariana	HLDB NDDB	Haryana

24 February 2017

PS Programmes for production of HGM bulls of different breeds

Breeds	Breed	EIAs	State
	Sahiwal	Sahiwal PS Project	Punjab/ Rajasthan
	Tharparkar	RLDB	Rajasthan
	Nili Ravi	PLDB	Punjab
 24 February 2017	Pandharpuri	MLDB NDDB	Maharashtra

PS Project under NDP I (10)



Progress under Pedigree Selection Programmes

	Functional AI Centers	Animal Registered	AI Done	Calving Reported	Daughter Registered	Animals Put to Milk Recording	Animals Completed Milk Recording	Bull Distributed
Kankrej	50	14620	24102	8396	3356	2288	1958	3
Rathi	50	41902	42928	13697	4998	2398	1132	11
SAG Gir	130	32396	40177	7424	2328	2626	1698	20
SAG Jaffarabadi	132	29999	36136	5175	1693	2572	2004	10
MLDB Pandharpuri	32	8198	9547	1340	462	758	244	0
RLDB Tharparkar	61	3202	2915	1	0	906	6	0
Gangmul Sahiwal	29	7762	8566	166	58	1312	18	0
PLDB Sahiwal	26	1617	2111	80	35	154	4	0
PLDB Nilli Ravi	58	6105	11617	712	272	743	246	0
Haryana PS	49	5497	6441	1302	556	3100	1857	0
Total	617	151298	184540	38293	13758	16857	9167	44

Challenges faced in implementing PS projects

- Animals artificially inseminated in native tract of indigenous breeds is limited
- Not possible to initiate PT programmes
- Convincing farmers for ear-tagging, AI and milk recording is a real challenge
- Animals let loose for grazing
- Demand for quality bulls for natural service limited in a situation where many stray bulls exist
- Castration of stray bulls
- Sustaining PS programmes

Main components of Breed Improvement

**Breeding policy and
Setting Breeding Goal**

➤ **Produce high genetic merit bulls through:**

- Progeny testing – in partnership with farmers
- Pedigree selection (indigenous breeds)
- ONBS – using Embryo transfer
- Genomics

➤ **Produce quality semen by:**

- Using only high genetic merit bulls free from disease
- Adhering to standards laid down
- Complying with bio-security measures

➤ **Provide quality AI service by:**

- Animal identification
- Maintaining effective LN delivery system
- Using semen from certified Semen station –as per breeding policy
- Ensuring hygiene & protocol
- Reducing number of AIs per conception
- Providing advisory services & inputs

**SET STANDARDS
EVALUATE PERIODICALLY
CERTIFY PROGRAMME**

**SET STANDARDS
EVALUATE PERIODICALLY
CERTIFY STATION**

**SET STANDARDS
REGISTER PROVIDER
EVALUATE PERIODICALLY**

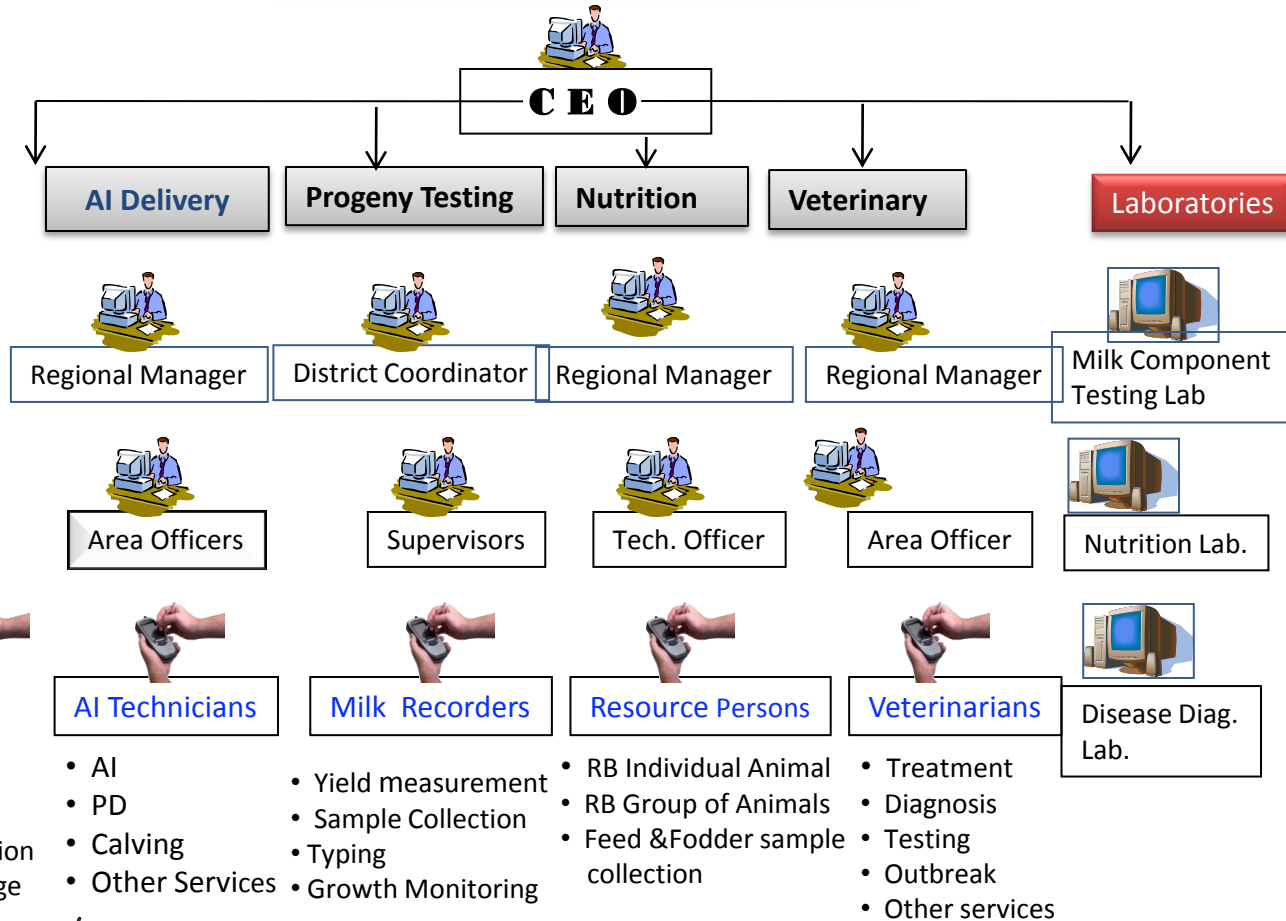
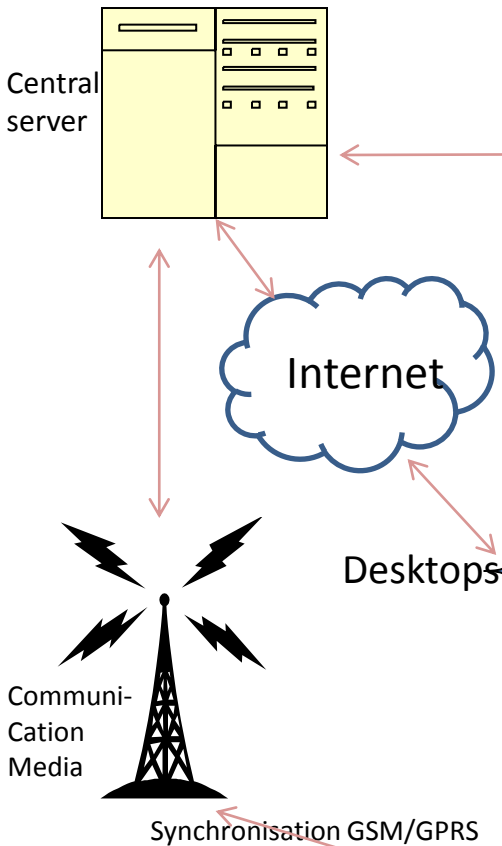
Maintain a live computerised database_use information_improve productivity

Network at a glance

NDDB

- Administration
- Analytical reports
- BV Estimation
- SMS Delivery

XYZ Organisation/EIA



PDA

1. Data entry
2. Data validation
3. Updation
4. Local output
5. Synchronization

Mobile

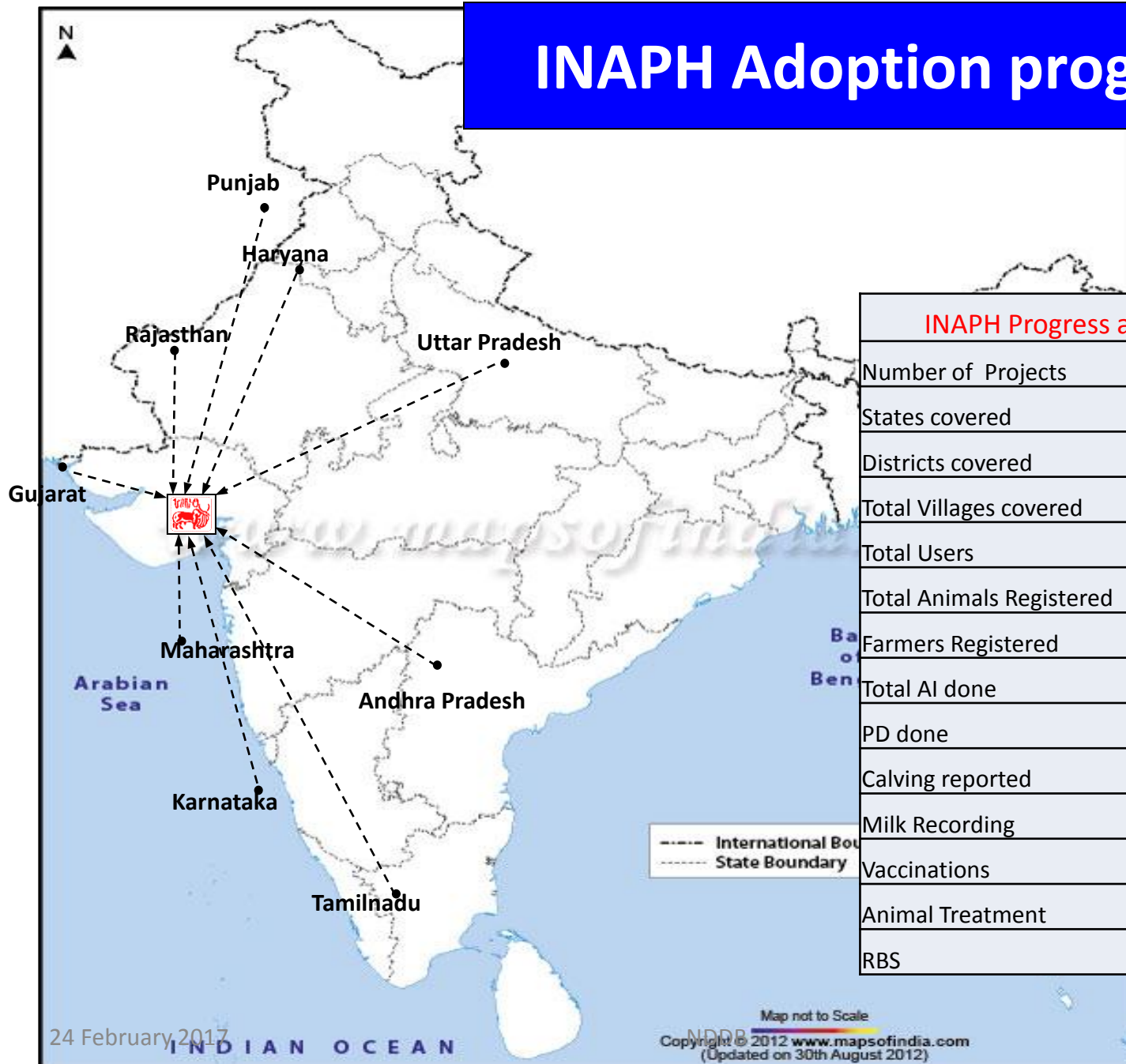


Farmer with animals in a village

SMS –
Alert
Messages

24 February 2017

INAPH Adoption progress so far



INAPH Progress as on 9th Feb 2017

Number of Projects	194
States covered	20
Districts covered	291
Total Villages covered	78,567
Total Users	39,429
Total Animals Registered	73,27,463
Farmers Registered	40,94,792
Total AI done	62,08,641
PD done	30,97,262
Calving reported	12,78,740
Milk Recording	19,25,062
Vaccinations	1,84,133
Animal Treatment	1,84,133
RBS	144,98,607

Quality Control

- CMU of GoI has been grading all semen stations biannually
- Under NDP, NDDB is evaluating all its genetic improvement programmes annually
- There is no system of control for AI Delivery in the country.
- A Bovine Breeding Bill has been prepared with a purpose to establish an Independent Authority for registration, evaluation and certification of :
 - bulls,
 - semen stations,
 - AI service providers, and
 - AI training institutions

Additional Issues to be addressed

- Raising demand for local breeds:
 - Raising productivity through systematic genetic improvement programmes
 - Developing niche markets for products of local breeds to raise their market value.
- Expanding infrastructure for AI in the native tracts of some of our promising dairy and dual purpose breeds
 - Subsidy to private service providers to expand AI network in native tracts
 - Castrate stray bulls
- Developing and managing common grazing lands
- Genetic improvement strategies and programmes need to be developed for 40.3 million non-descript adult female cattle and 24.4 million non-descript adult female buffaloes

Draft Breeds

- 46.7 million adult cattle males; 9.7 (or 20.7%) belong to well-defined breeds and remaining 37 million non-descript.
- Of the 9.7 million adult males of defined breeds, 5.2 million (or 53.6%) belong to draft breeds and the remaining to dairy and dual purpose breeds.
- Need to develop genetic improvement programmes for development of 24 draft breeds
- Pilot projects for genetic improvement of important 4-5 draft breeds could be developed in the field

Thank You