

Status of underutilized animal genetic resources for food and agriculture at East Asia

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East Asia: Growth in the production and consumption

- ▶ Asia has experienced dramatic increases in the production and consumption of livestock products in recent decades.
- ▶ The production of milk and meat in East Asia proceeded at a faster pace for both meat and milk compared with other Asian regions.

	Production				Consumption			
	Meat		Milk		Meat		Milk	
	1991-2007	2005/2007-2030	1991-2007	2005/2007-2030	1991-2007	2005/2007-2030	1991-2007	2005/2007-2030
Developing countries	4.2	2.1	1.6	1.3	4.1	2.2	3.9	2.1
East Asia	4.5	1.9	9.5	2.2	4.7	1.9	7.9	2.2
South Asia	1.6	4.4	4.1	2.3	1.2	4.5	4.1	2.3
Southeast Asia	4.7	2.6	5.4	4.7	n.a.	n.a.	n.a.	n.a.

Adapted from data used in FAO (2011)

Trend in livestock production in East Asia

- ▶ The rapid rate of growth for meat and dairy products in East Asia is attributable mainly to China.
- ▶ Due mainly to very rapid per capita income growth and associated diversification away from food staples towards animal products.

	East Asia			South Asia			SE Asia		
	Production	Annual growth (percent)		Production	Annual growth (percent)		Production	Annual growth (percent)	
		1991-2007	2005/2007-2030		1991-2007	2005/2007-2030		1991-2007	2005/2007-2030
Poultry	15 722	6.8	2.3	2 771	6.8	6.4	5 299	5.1	3.0
Pigs	47 378	3.3	1.3	492	0.7	1.9	6 113	5.1	2.3
Eggs	27 860	5.4	1.0	4 235	5.3	3.4	3 505	3.6	2.6
Beef	6 624	6.9	2.7	4 039	1.6	2.4	1 468	2.4	2.4
Mutton	3 770	7.0	1.4	2 011	0.8	2.4	207	3.1	1.8
Milk	46 602	9.5	2.2	143 765	4.1	2.3	3 201	5.4	4.7

Growth in production of livestock commodities in Asia ('000 tonnes)

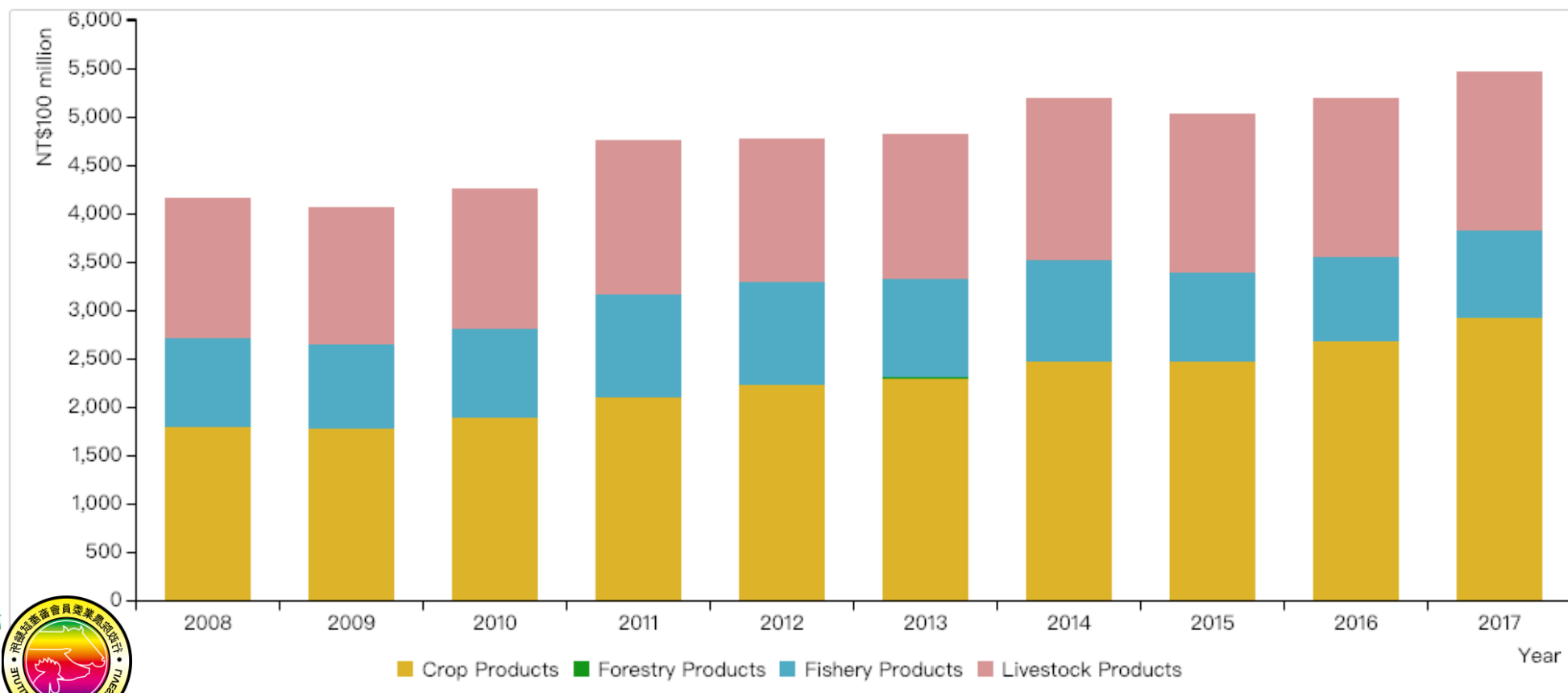
Asian contribution to world animal population and meat production

- ▶ Asian share of world total meat production has been quite low when compared to its animal population.
- ▶ Although the demand in East Asia countries for animal proteins is increasing, animal production is not keeping pace with the growth in demand.
- ▶ The livestock industry is growing in this region, especially good progress has been made in the poultry sector.

Animal Species	Population in Million Heads			Meat Production in Million tonnes		
	Asia	World	Asian Share %	Asia	World	Asian Share %
Cattle	464	1,338	34.7	10.5	55.3	18.9
Buffalo	153	158	96.8	2.8	3.0	93.3
Pig	527	912	57.8	47.0	87.9	53.4
Chicken	7,080	14,139	50.0	16.5	52.0	31.7
Sheep	412	1,068	38.5	3.3	7.5	44.0
Goat	446	709	62.9	2.7	3.7	72.9

Production and consumption

Production Value of Agricultural Products



Importance of livestock in economy and food security

- ▶ Domestic animals supply for food and agriculture requirements.
- ▶ Livestock germplasm exchange driven by global production systems.
- ▶ A high percentage of exotic blood for livestock breeding.
- ▶ High-output international trans-boundary breeds replace local breeds for enhancing livestock production.



Lanyu miniature pig



Lanyu miniature pig

- habitat loss
- social value sinking



Biogenetic resources are parts of our life.

Genetic diversity is threatened by

- genetic erosion
- habitat loss
- social value sinking
- economic setback
- food print mileage



Sustainable growth in the livestock development in East Asia

- ▶ Many Asian countries adapted various methods to improve local livestock population.
- ▶ Indigenous genes are rapidly disappearing due to cross breeding. However, many local breeds have special adaptive traits for disease resistance, ability to survive on adverse conditions such as high temperature, poor quality feed and water.
- ▶ Preserving this genetic variation specific to their environments will be important in future sustainable development in livestock production.

Status of AnGR



Native breeds and
conservation sites



Water buffalo



Cattle



Goat



Sika deer



Sambar



Pig



Horse



Sheep



Rabbit



Duck



Chicken



Turkey



Goose



Swan



Muscovy



Figure 1. Farm animal genetic resources in Taiwan.

Animal genetic resources in East Asia

- ▶ China has a long history of livestock and poultry with rich gene resources. More than 300 domestic livestock and poultry breeds and groups of varieties.
- ▶ Japan has relatively rich and varied livestock and poultry resources among countries of East Asia. The exotic breeds and crossbreds play an important role in animal production. Nearly 30 livestock and poultry breeds preserved.

Unique underutilized AnGR

- ▶ The existence of threats to undervalued and underutilized AnGRs.
- ▶ Adaptive characteristics of native breeds may provide useful genes for future needs.
- ▶ Prolificacy, early maturity, heat tolerance, disease-resistance, roughage tolerance, and special meat flavour.

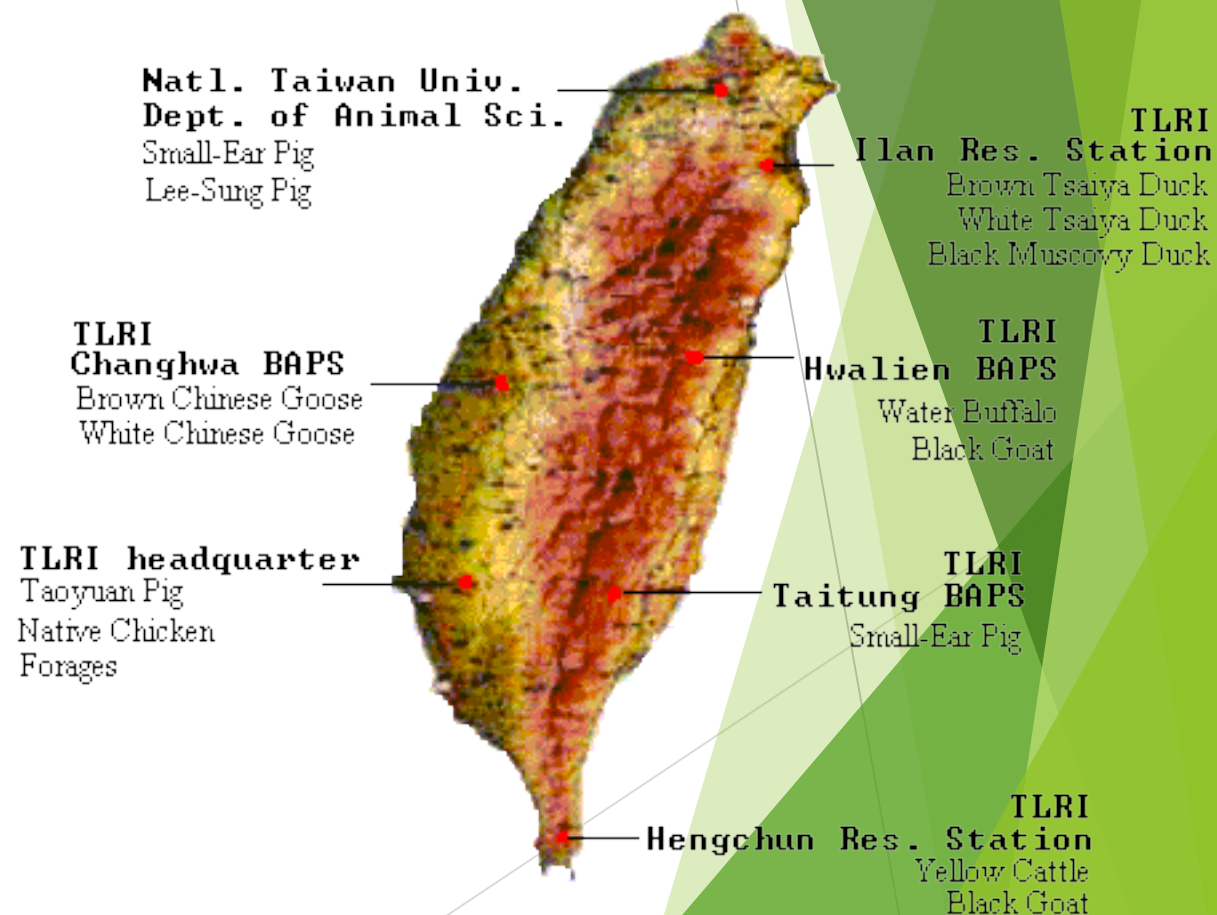
臺灣畜產生物

Genetic Resources for Animal Industry in Taiwan

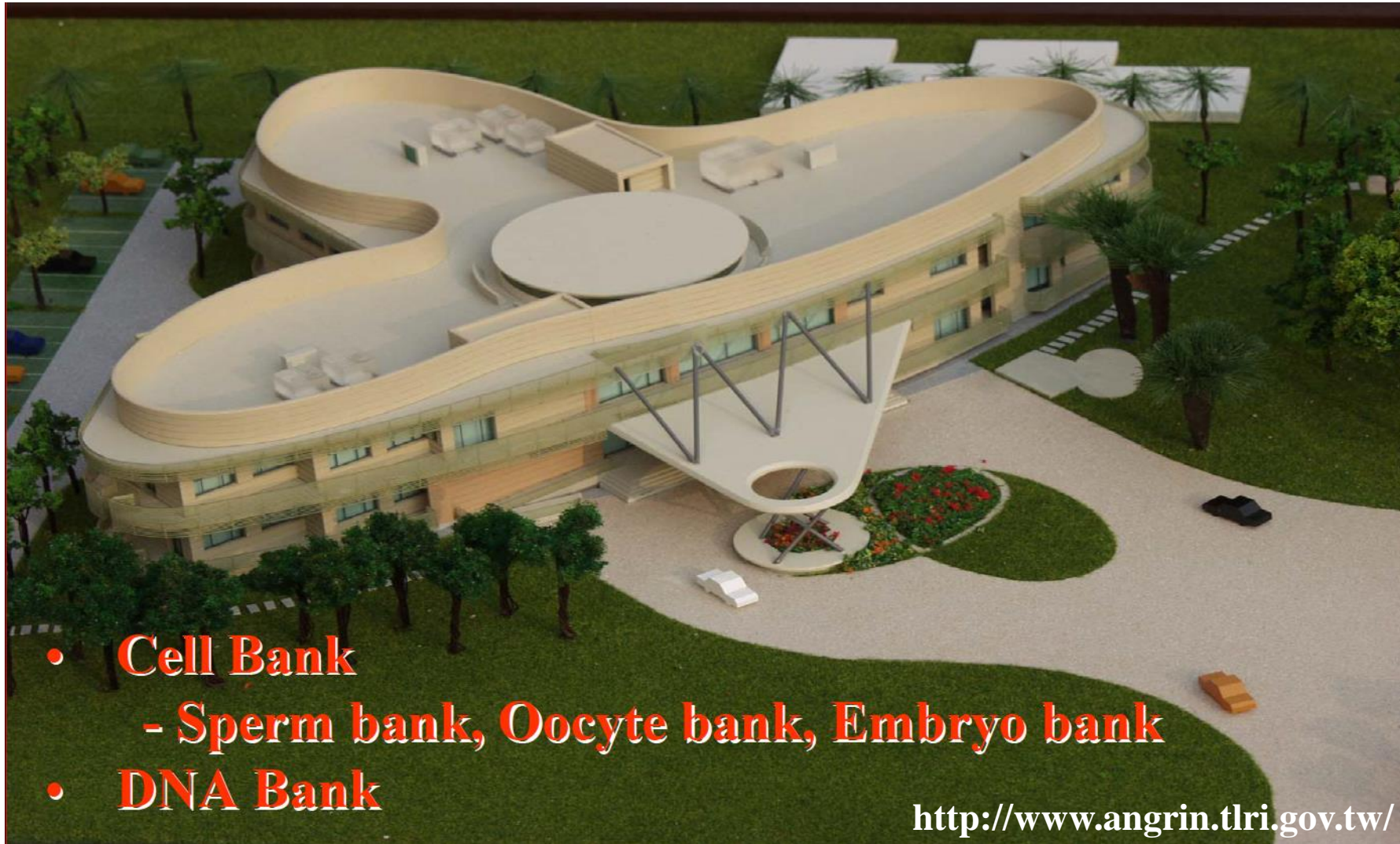


Germplasm preservation and utilization in domestic animals

- ▶ A large-scale pilot national project, “Germplasm Preservation and Utilization in Domestic Animals”, was initiated in 1987
- ▶ Maintaining live populations, cryopreserving germ cells, and establishing DNA stores
- ▶ Living germplasm are preserved at LRI branches at different locations in Taiwan



Taiwan Animal Germplasm Center



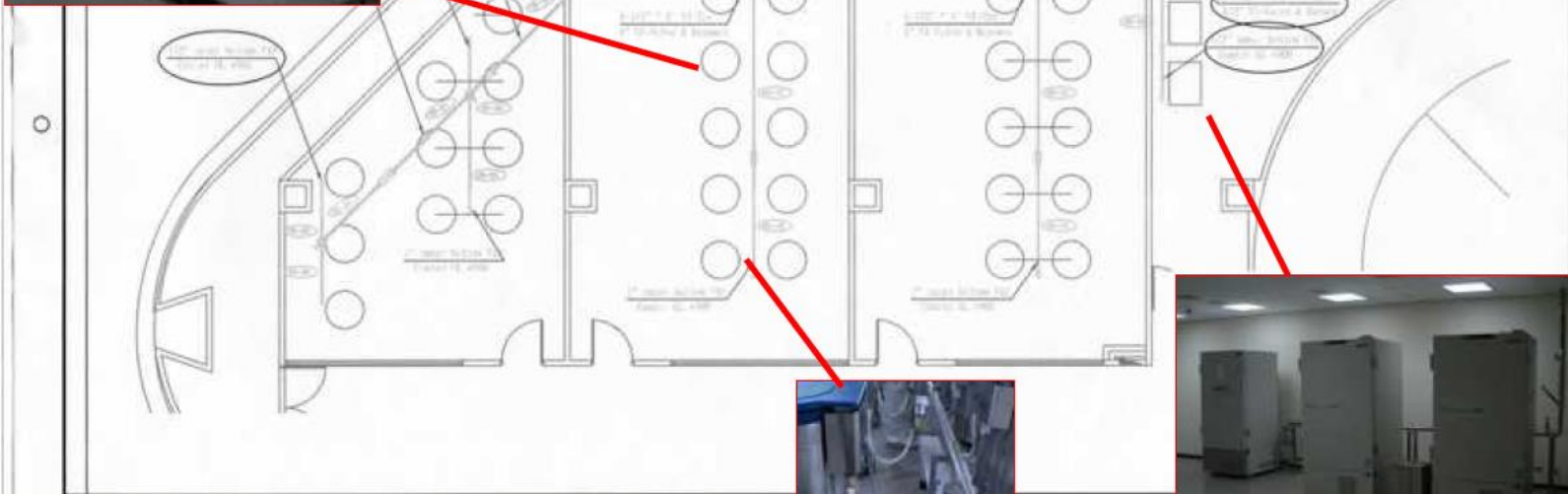
- **Cell Bank**
 - Sperm bank, Oocyte bank, Embryo bank
- **DNA Bank**

<http://www.angrin.tlri.gov.tw/>

CryoBanking



LN2 Tank : SCS-20000
(ADM Grade)
桶 高 : 1040 cm
直 徑 : 220 cm
基礎中心直徑 : 200 cm
全重(含液氮) : 37000 kg



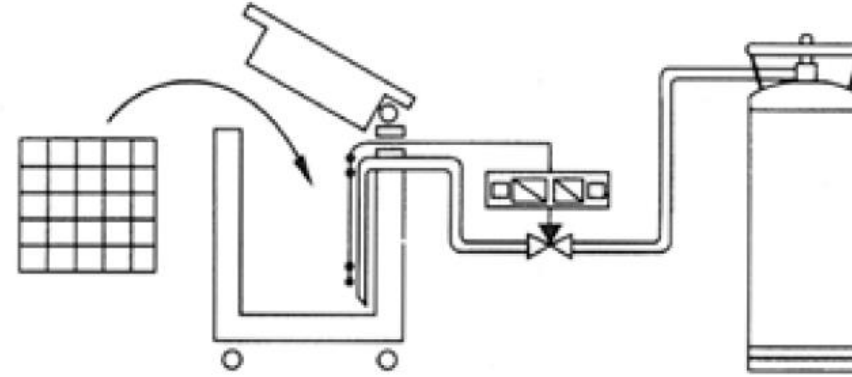
Taiwan Animal Germplasm Center
<http://www.angrin.tlri.gov.tw/>

Small LN Tank



•**K Series** - Liquid nitrogen storage with controllable temperatures between (-100°C to -196°C)

The K Series System



-185°C Vapor storage



-80°C Freezer

•designed for large vial capacities up to 6000 vials (2 ml vial) in box type racks.



LN CryoSystem



- Germ cell (sperm, egg and embryo)
- Tissue
- Somatic cell
- Cell line
- DNA and gene pool

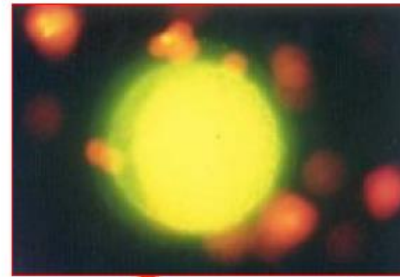
Taiwan Animal Germplasm Center

<http://www.angrin.tfri.gov.tw>

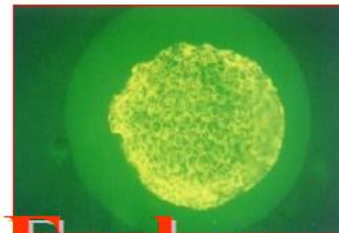


DNA Banking

Cattle	6180
Water Buffalo	58
Goat	3127
Sheep	14
Horse	14
Rabbit	88
Swine	25129
Chicken	11650
Muscovy	151
Duck	689
Hybrid Duck	128
Goose	431
Turkey	14
Black Swan	135
Quail	50
Total	47858



Oocyte



Embryo

Gene Banking

Living form/Cell/Tissue
DNA/RNA/mRNA/cDNA/Protein



Black Muscovy



White Muscovy



**Black Muscovy
with black facial skin**



Farm owner found the phenotypic difference and conserved the new genetic resources under a traditional breeding scheme provided by the Institute.

Genetic Resources Center, NARO, Japan

- ▶ Livestock and poultry genetic resources are preserved using fertilized eggs, semen and somatic cells or in situ using live populations of animals.

Animal Name	Form of conservation
Cattle	Semen, fertilized eggs, somatic cells, <i>in situ</i> conservation
Water buffalo	Semen
Horse, pig and goat	Semen, <i>in situ</i> conservation
Sheep	Semen, somatic cells
Rabbit	Fertilized eggs
Chicken	Semen, PGC, <i>in situ</i> conservation
Quail	<i>in situ</i> conservation



Centre of Livestock and Poultry Germplasm Resources, China

- ▶ Samples of embryos, blood and DNA of livestock and poultry are stored in liquid nitrogen tanks.
- ▶ The purpose of storing these genetic materials is so they can be used by advanced biotechnology to revive the species if they were extinct.
- ▶ When genetic resources are needed, they can be taken out of the tanks and released.
- ▶ The germplasm resources stored here can be used for pure breeding or cross breeding of livestock and poultry through exchanging genetic resources.

Challenges and opportunities: DNA in food chain

- ▶ Domestic animal resources are preserved for improving exotic breeds in terms of future production performance and efficiency
- ▶ Sequencing local animal genomes to improve health, adaptability, and production
- ▶ Improving adaptability of livestock breeds to climate change and disease to allow greater feed efficiency and other desirable traits
- ▶ Developing DNA-based technology to predict genetic merit for traits such as feed efficiency and other desirable traits



Sequencing summary of indigenous Taiwan Yellow Cattle

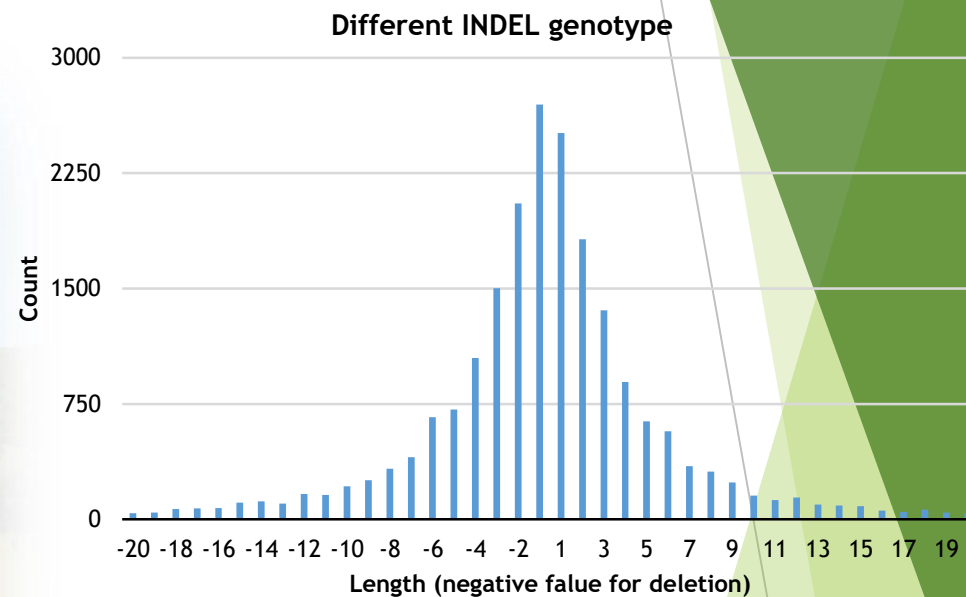
Sample name	Total read number	Read length (bp)	Total read after QT*	Average Read Length after QT*
臺灣黃牛 KTYC02_1	359,753,773	150 bp	359,740,860	149.13 bp
金門黃牛 KTYC03_2	332,489,663	150 bp	332,461,222	148.93 bp



*QT: Quality Trimming



Variant summary of indigenous Taiwan Yellow Cattle

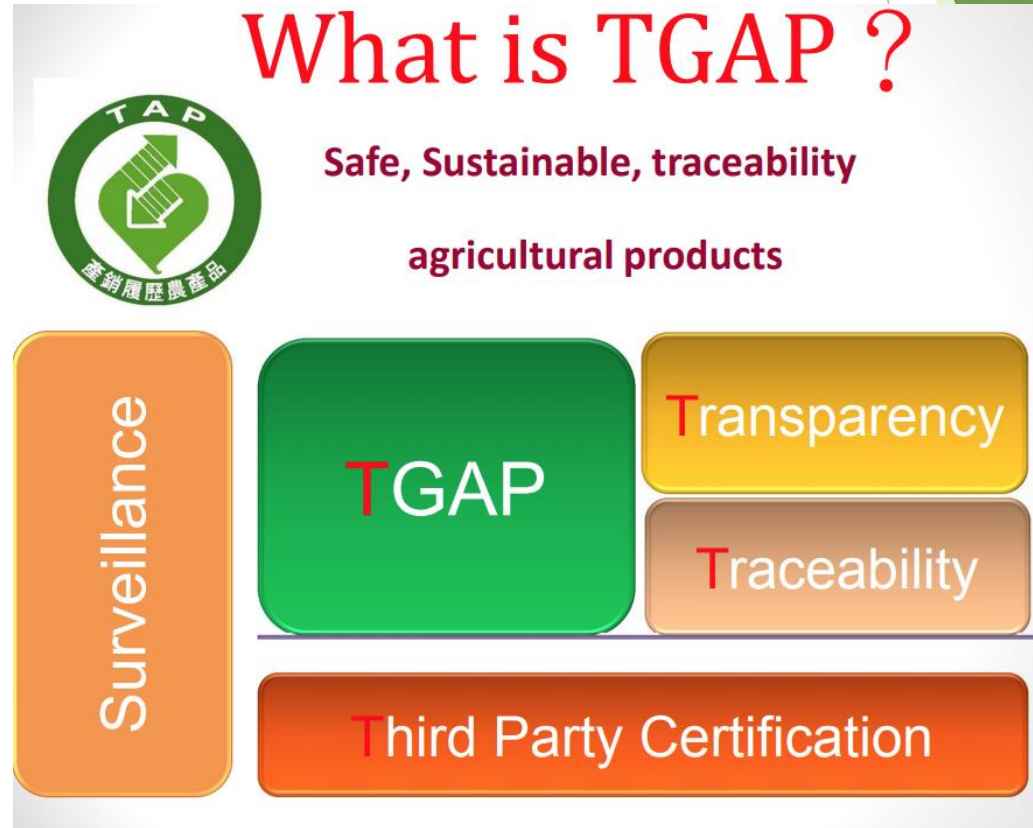
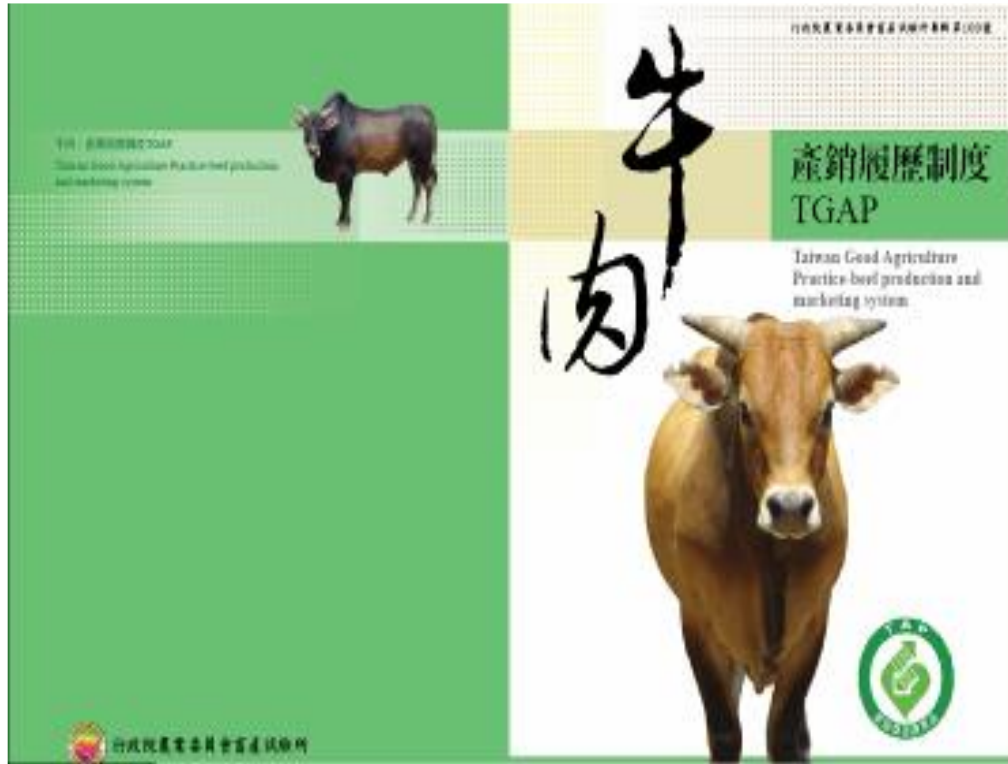


Variant	Different genotype
SNP	17,950,571
INDEL	3,747,048



Taiwan Good Agriculture Practice (TGAP)

SINCE 2009



產銷履歷追溯號碼查詢

說明

輸入您購買的產銷履歷追溯碼或商品國際條碼

查詢



現在位置： 首頁 > 履歷大集合 > 履歷列表

回上一頁

履歷列表

農業經營業者：
 瀏覽查詢： 全部
 關鍵字查詢：
 產品名稱： 全部 全部 查詢 重填

共 1442 筆資料，第 173 頁，每頁顯示 20 筆， 上一頁 到第 1 頁 下一頁

追溯號碼	農業經營業者	產品名稱	包裝日期
501130335900254	鉉景國產肉品專賣店	牛肉	2013/05/07
550113033490023	鉉景國產肉品專賣店	牛肉	2013/05/07
025501130334801	鉉景國產肉品專賣店	牛肉	2013/05/06
130333700255017	鉉景國產肉品專賣店	牛肉	2013/05/04
011303315002555	鉉景國產肉品專賣店	牛肉	2013/05/04

共 1442 筆資料，第 73/73 頁，每頁顯示 20 筆， 上一頁 到第 73 頁 下一頁

追溯號碼	農業經營業者	產品名稱	包裝日期
011000041001555	鉉景國產肉品專賣店	牛肉	2010/12/16
110000190015506	鉉景國產肉品專賣店	牛肉	2010/12/13

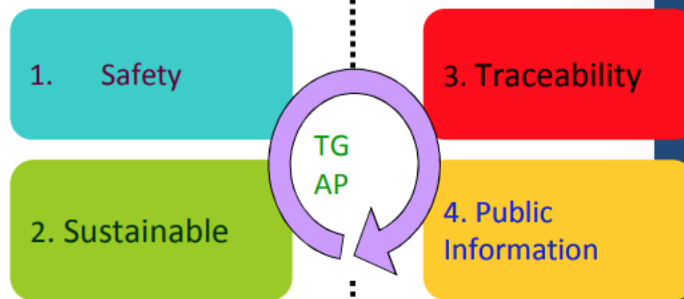


Sampling inspection by Competent authority

Standard

Assessment System

core values



Approach

Record all operation

Record shipments; Upload a partial record

Certification

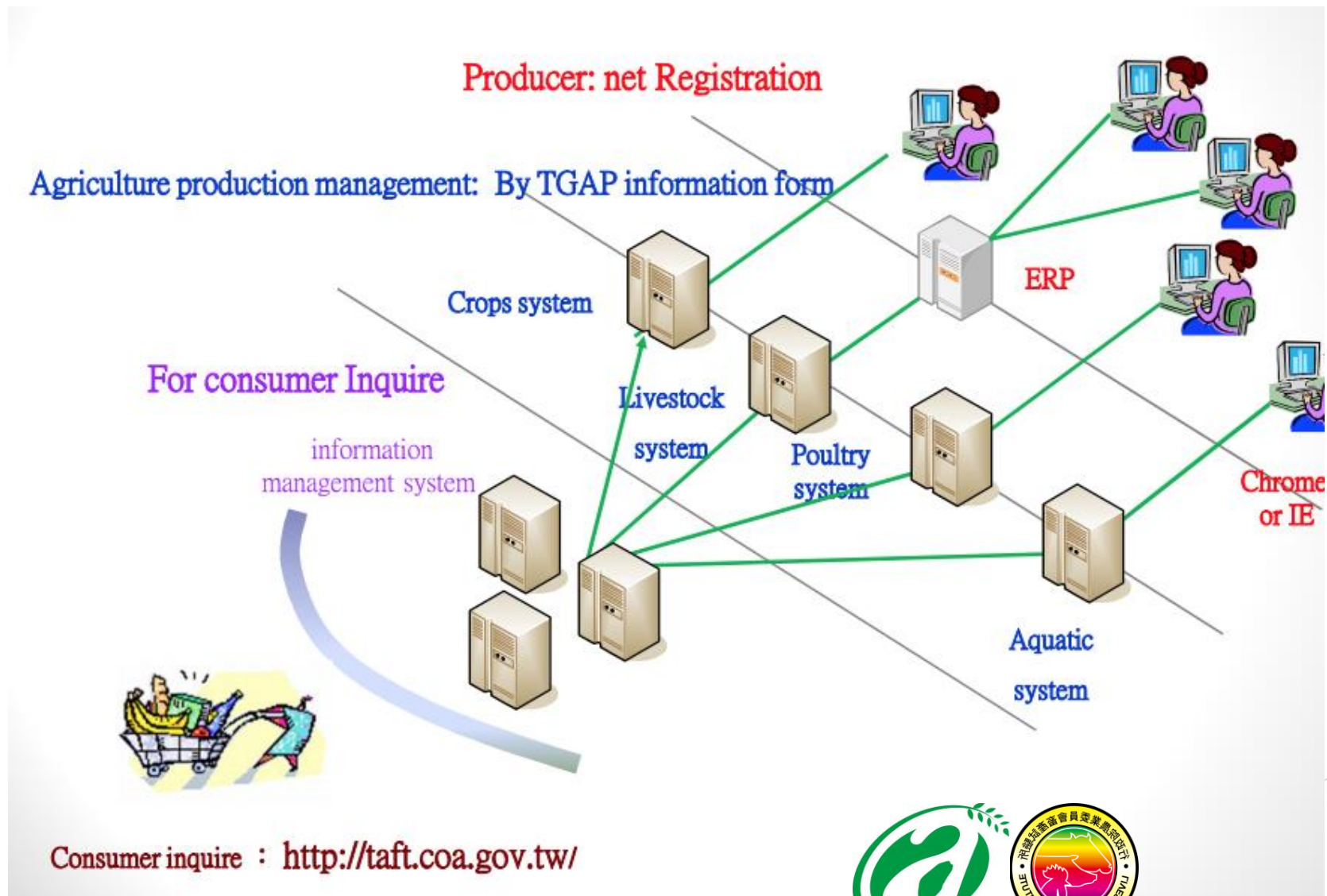
COA(Council of Agriculture, Taiwan)

Accreditation

TAF(Taiwan accreditation foundation)



TGAP information system



Regulations law on TGAP

- ▶ Agricultural Products Production and Verification Management Act
- ▶ Set time : 29/1/2007 make an announcement
- ▶ Legislative purpose: To enhance the quality and safety of agricultural products and processed products, safeguard the national health and consumers.

T: Traceable 、 **T**aiwan

A: Agricultural

P: Product

- **Green leaf** (agriculture product)
- **Bidirectional flow arrow**
(**Trace** 、 **Track**)
- **G-Glyphs** (**Good product**)
- **Heart-shaped** (**Peace of mind, confidence, assured**)



TGAP product label



1. Mark
2. Product name
3. Traceback code
4. Information disclosure (URL + trace code)
5. The name of verification organization



TGAP product supermarkets



TGAP traceability restaurants

王品集團	良食究好	礁溪老爺酒店	八甲休閒農場	大戶屋 24間分店	御牛殿 4間分店	滿穗台菜	沃田旅店
漁聞樂 日本料理	想想廚房	東方韻·黔天下 東方韻·私房黔	福來許	獵果鋪	三韻茶飲 7間分店	豐盛號	東香台菜海 產餐廳
絢賞風尚 鐵板燒	雅室牛排館	魏姐 包心粉圓	凱恩斯岩燒	彼克蕾友善 咖啡館	約克夏	好食.House	哈古小館
雪飛詩歐廚	幸福樂章	美食無敵家	Buono Bella 波諾	Tiamo提亞摩 2分店	紐約牛排	喜歡你餐坊	禾豐田食

TGAP traceability restaurants

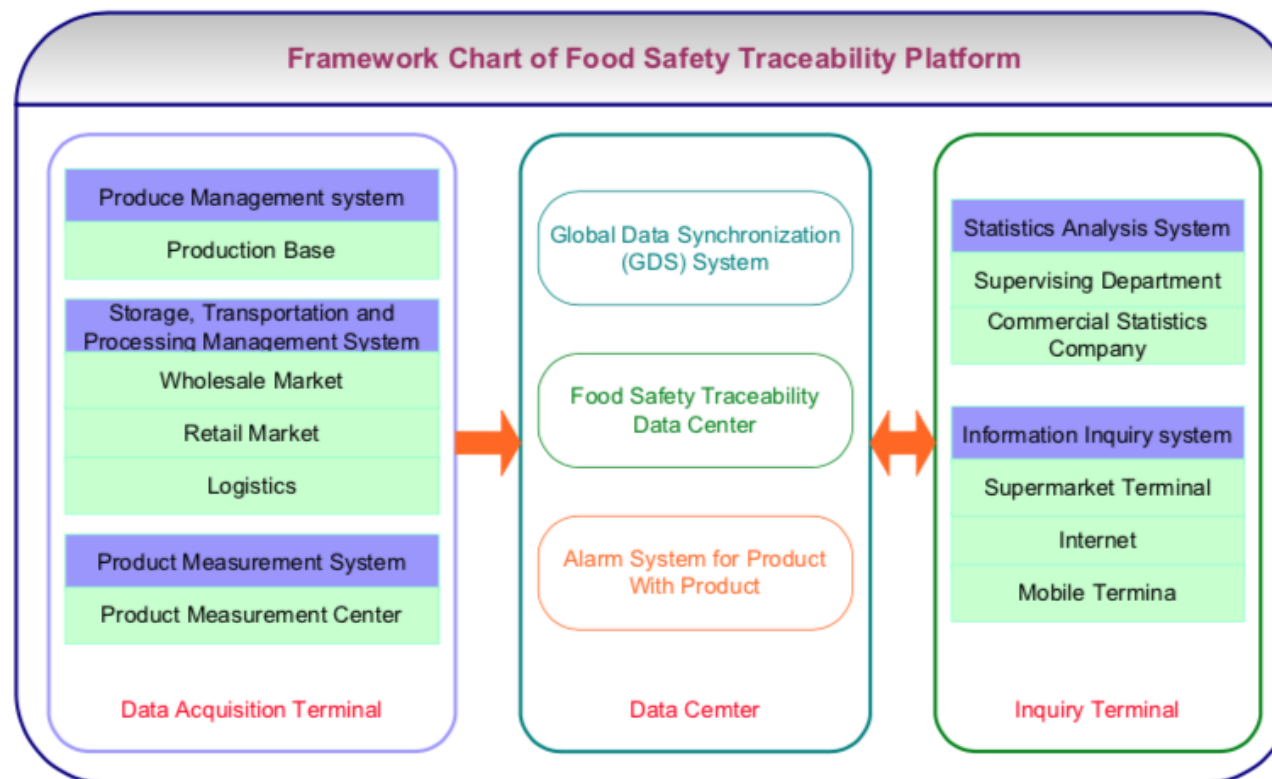
							
烏苑地雞燒	禾堤日本料理	京華煙雲	家.溫度 湯專賣店 2分店	不設限食飲空間	膳馨民間創作料理	驛站房東北酸菜白肉鍋	樸樹文旅
							
鹽與胡椒	於光	故事咖啡館	牛佬牛肉麵	老吳的西洋料理	裕毛屋 3分店	卦山月圓	小銅鍋
							
宏科醫院-產後護理之家	La one kitchen	One One café'	Thomas Chien	Ya Ya 綠廚房	Dulan Crap 法式料理	圓環龍鳳號	法朵新馬德里鐵板燒
							
饗宴精緻石頭火鍋 2分店	聖吉米納諾	煥富貴	七味亭 4分店	百草三味	涓豆腐 11分店	涓伙鍋 2分店	銅盤燒烤 2分店

TGAP products



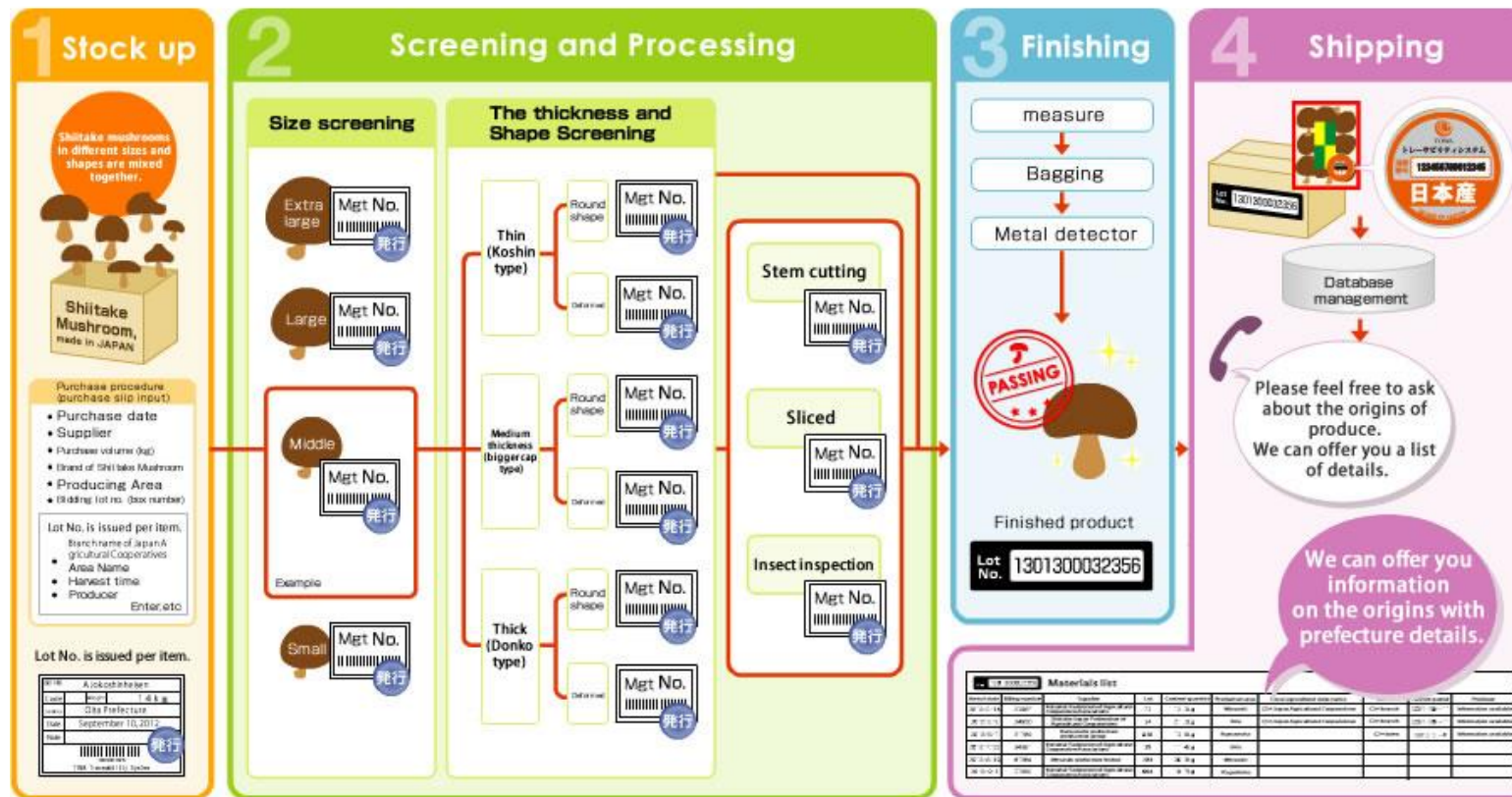
Food safety traceability system in China

- ▶ In China, the food safety traceability platform by bar code.
- ▶ Food safety traceability system (FSTS) is an information management system that can connect the production, inspection, supervision and consumption.



Japanese food traceability systems

- ▶ In Japan, the use of ICT in food traceability systems is relatively advanced.
- ▶ The traceability systems facilitate improved efficiency in the management of the supply chain.



Research strategies

- ▶ Researching and utilization of molecular techniques to verify and understand the genetic basis of AnGRs.
- ▶ Comprehensive assessments of genetic diversity of local breeds.
- ▶ Genetic variations within livestock species.
- ▶ DNA libraries and genome sequencing of local breeds for revealing the genetic bases of disease resistance, adaptation to environmental stresses, and production efficiency.



Scheme of Biodiversity Databases Integration in Taiwan

Other existed websites and databases:

Institutions, natural heritages, research projects, societies (NGO), organisms

Council of Agriculture

Invasive species
(COA-BAPHIQ 防檢局)

Endemic species
Eco-engineering
(COA-ESRI 特生中心)

Biodiversity indicators
(COA-GA 糧農處)

Resources & distribution
(COA-TBRD, TARI 農試所, TFRI 林試所, FA 漁業署)

Gene bank
(COA - NPGRC
作物種原中心)

National Science Council

Cataloging specimens
(NSC-NDAP)

Taxonomic &
basic information
(NSC-NDAP &
NBRPP 推動計劃)

Literature, research,
projects, symposia,
keywords, terminology.
(NSC-STIC 科資中心)

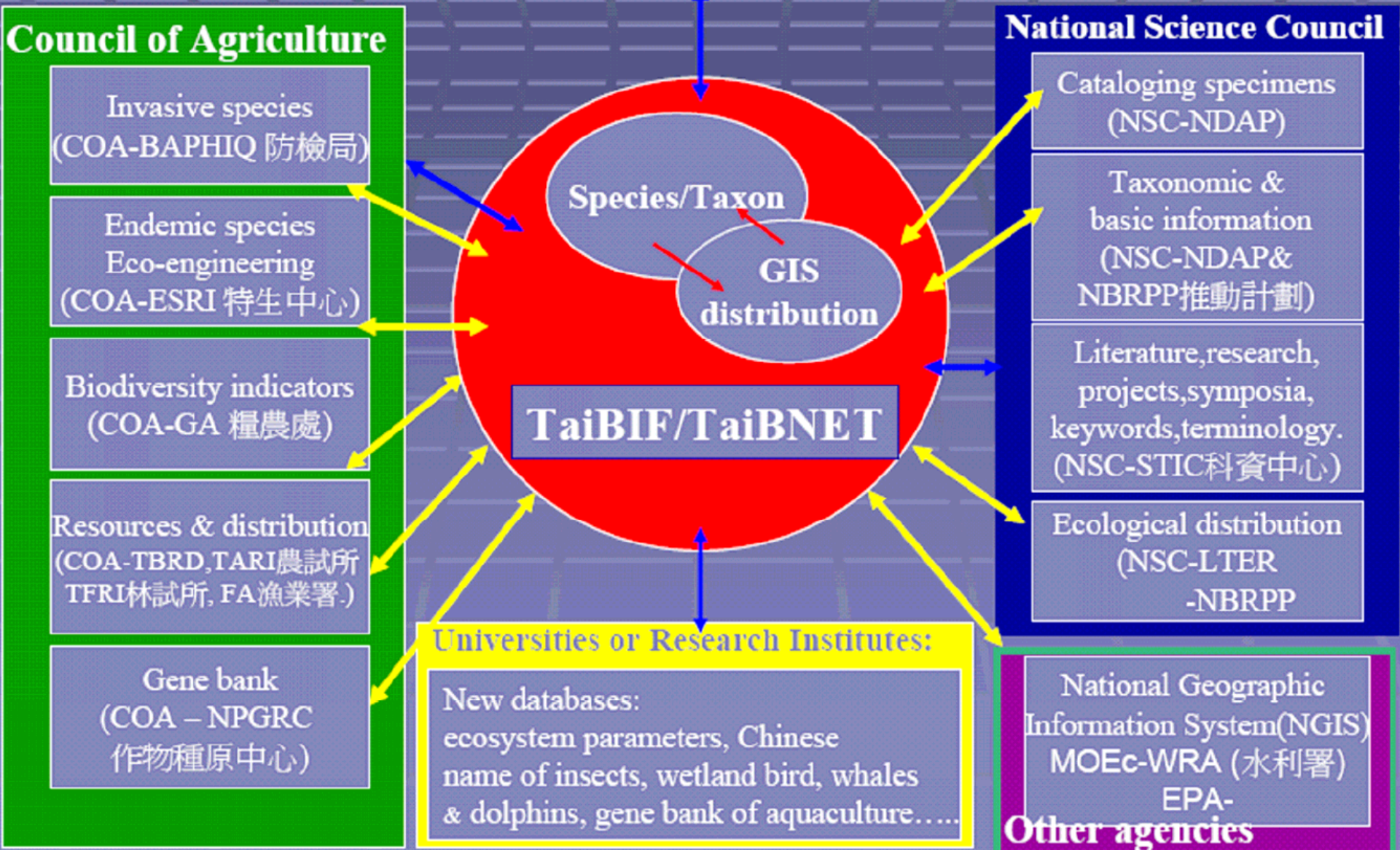
Ecological distribution
(NSC-LTER
-NBRPP)

Universities or Research Institutes:

New databases:
ecosystem parameters, Chinese
name of insects, wetland bird, whales
& dolphins, gene bank of aquaculture.....

National Geographic
Information System (NGIS)
MOEc-WRA (水利署)
EPA-

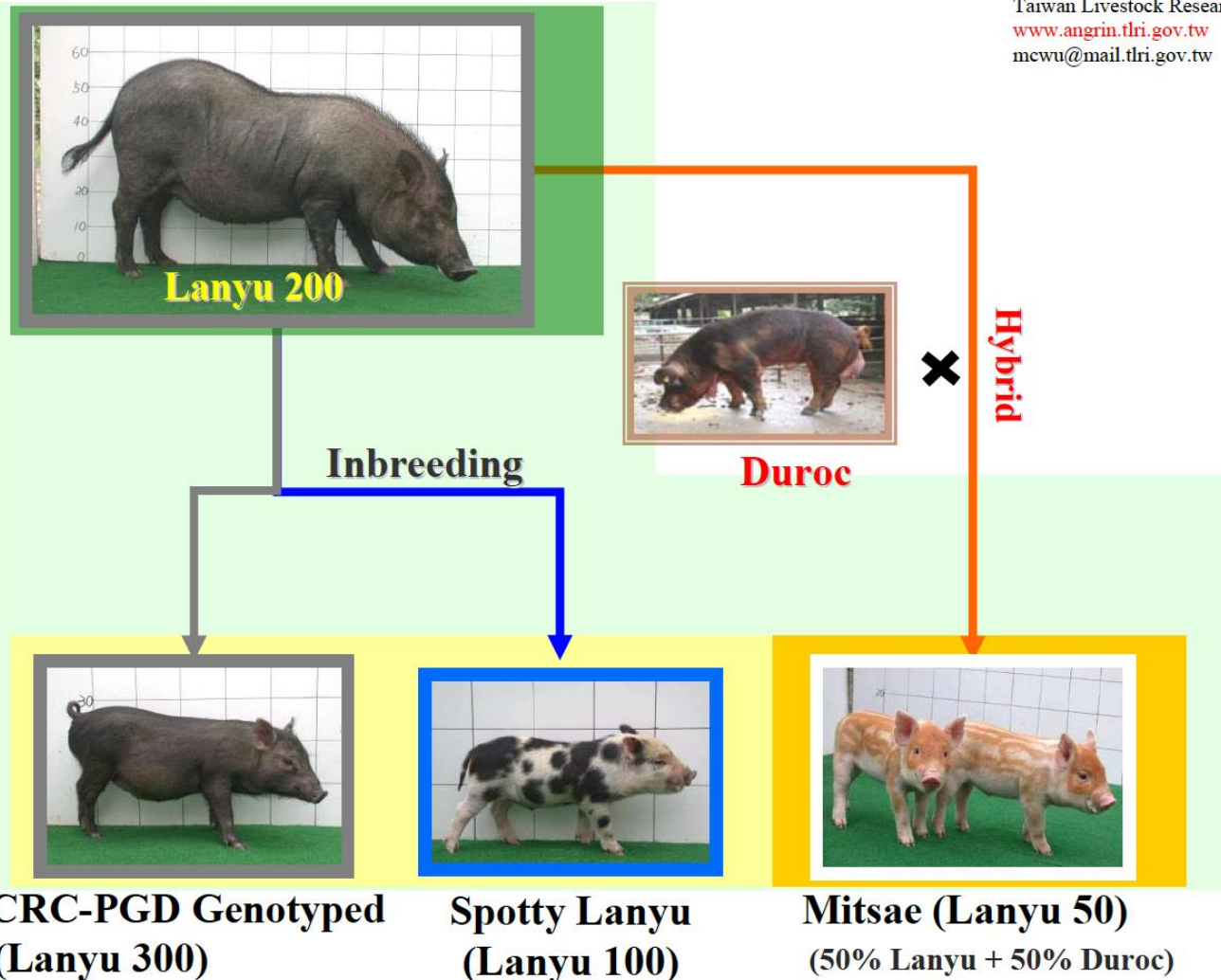
Other agencies



Success story for Lanyu miniature pigs

Development of miniature pig for biomedical research in Taiwan

Ming-Che Wu, PhD
Taiwan Livestock Research Institute
www.angrin.tlri.gov.tw
mcwu@mail.tlri.gov.tw



Development of miniature pig for biomedical research in Taiwan



Lanyu 200

**Conservation to Bio-
utilization (1987-2008)**

Ming-Che Wu, PhD
Taiwan Livestock Research Institute
www.angrin.tlri.gov.tw
mcwu@mail.tlri.gov.tw

Lanyu 300
Lanyu 50
Lanyu 100



**Fullsib Mating on
coat color selection**

Lanyu 100
Lanyu 50



Lanyu
Black
1980

Lanyu 500
Lanyu 100
Lanyu 400



Spotty Lanyu
1993

Lanyu White
2005

Association for
Assessment and
Accreditation of
Laboratory Animal Care
(AAALAC)

Future thrusts

Breed, Quality and Value



- Livestock
- Poultry



Thank you

