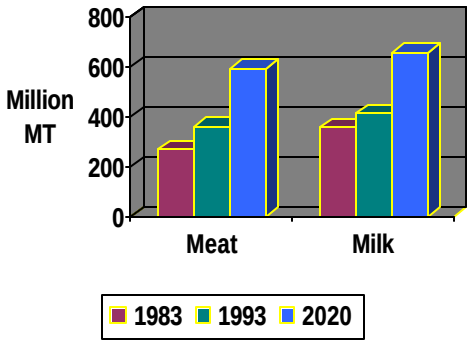
The National Animal Germplasm Program (NAGP)

USDA/ARS/NPA/NSSL 1111 S. Mason St., Ft. Collins, CO.

Flexibility for economic growth and production of high quality protein through biodiversity

Preparing for the Future: The next twenty years will bring unprecedented growth of the global livestock sector. As a result U.S. livestock industries will have an important opportunity to grow with increasing global demand.



CAST (1999) projections of global demand for meat and milk from 1983 to 2020.

Importance of Genetic Diversity: To meet growing demand, U.S. livestock and aquatic species are produced in a wide array of environments that have different management systems. Genetic combinations present within breeds and between breeds are the building blocks for these management systems. Without genetic diversity we lose the ability to develop new and more efficient production systems and to change livestock products to meet consumer demands. Furthermore, as new disease challenges emerge, access to diverse genetic resources can be used in developing genetic resistant lines to meet the new challenge. A loss of genetic diversity could result in American producers becoming less competitive in global markets. In competitive markets farmers intensely select for economically desirable traits. As increased selection pressure is applied to a few traits genetic diversity is decreased across the genome. Such a change reduces flexibility to meet market needs, environmental changes and disease challenges. When industry finds itself in such a situation there is a need to have alternative genetic stocks available to correct such problems.

What can be done: A national program, combining information and biological technology is needed to monitor, assess and conserve animal and fish genetic diversity. In fact, such a program has been in place for agronomic crops since the 1950's. Cryopreservation of germplasm (semen, embryos and other tissues) and maintenance/utilization of live animal populations can ensure ready access to unique breeds or lines within breeds.

The National Animal Germplasm Program: The NAGP's goal is to effectively conserve and facilitate the utilization of animal and fish genetic resources for:

- **Economic development;**
- **Providing high-quality food & fiber products; &**
- **Promoting & sustaining biodiversity.**

The Mission: To develop a national system for conserving and utilizing animal and fish genetic resources. The fully developed system efficiently collects, evaluates and stores animal germplasm for present and future use. The system assesses genetic differences within species, environmental modifiers on livestock performance and the viability of livestock populations. When genetic resources are at risk of being lost, appropriate industries and collaborators are notified and strategies for preventing further genetic erosion and potential recovery paths are developed.

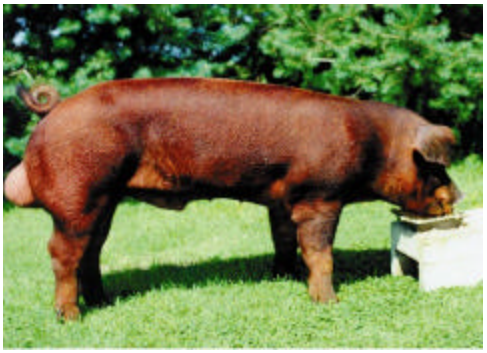
Our Partners: In carrying out its mission, the NAGP interacts with industry/clients for each species, international organizations and university research collaborators.

Background: In 1990 Congress gave the Agricultural Research Service a mandate to develop a germplasm program that monitors, conserves and increases utilization of the Nation's animal genetic resources. Prior to 1999 research focused on genetic differences at the molecular level and maintenance of animal populations. In October 1999 ARS determined that the Animal Germplasm repository would be located at the National Seed Storage Laboratory in Fort Collins, CO. At this center germplasm could be cryopreserved and a national computerized information system developed. Presently the information system is being developed; infrastructure is being put in place to collect and store germplasm and other tissues from livestock species; and research need identification.

The Discover Conference

In November 1999 a seminal meeting sponsored by the American Dairy Science Association, industry, ARS and CSREES was held. Over sixty scientists and industry representatives from the U.S., Europe, Canada and Mexico attended. Working in species groups and plenary sessions, they discussed the status of U.S. genetic resources, the need for preservation and increased utilization to meet global demand. The group agreed that there is a need for the NAGP and for greater linkages between the scientific community and industry in utilizing and preserving animal genetic resources.

Species groups identified industry problems, research needs and opportunities for each species when genetic diversity is maintained or enhanced. For poultry and swine, narrowing of the genetic base was seen as an important issue, that can be addressed by the NAGP. The dairy cattle industry has concentrated on one breed, that also may limit genetic diversity. This potential problem can be addressed through timely identification and cryopreservation of bulls and cows. Beef cattle and small ruminant committees underscored the need to utilize the NAGP as a mechanism for exploring the productive potential of genetic resources in and outside the U.S.



Across species research needs were identified that facilitate development and utilization of our national genetic resources. These include:

- Problems with poor freezing semen, ability to freeze and wash embryos, freezing and culturing oocytes need resolution.
- Diagnostic tools are needed to access the health status of cryopreserved material.
- Across species breed evaluation for resistance to diseases, environmental tolerance and production system technology.
- Genome exploration is needed to elucidate gene function, gene interaction and identification of novel genes and gene combinations.
- Reconstitution strategies of lost or endangered genetic resources need to be developed.
- Presently there is no methodology that allows industry and scientists the ability to assess risk of losing genetic resources. Such an effort requires input from industry, biologists and economists.

. Program Status

Building on the Discover Conference results, ARS has proceeded in establishing the NAGP. Four primary thrusts are under development:

Partner and Client Committees: For each species a committee has been formed which is comprised of industry and scientific members. These committees will provide input into the identification of genetic resources that should be placed in repositories and to assist in assessing the diversity of the nation's genetic resources. Currently, committees have been formed, chairmen named and initial meeting dates established.

Information System: The information system being developed will consist of three major components:

- A database to keep track of germplasm stored and the primary characteristics of breeds and lines within breeds.
- A genetic resource evaluation component allowing users to evaluate genetic resources for their genetic merit across varying environments and productions systems.
- A genetic resource warning component. That provides information on the endangered status of genetic resources and provides users with a decision-making framework to best chart a course for preserving (either live or in cryopreservation) endangered resources.

Repository Capacity: Linkages between the NAGP central repository in Fort Collins and satellite repositories are being developed. Along with this comes the need to develop the physical and human infrastructure necessary to curate the vast genetic diversity of the livestock sector and to assure it is maintained in a state of readiness for future use.

Status of the National Resource: In conjunction with the American Livestock Breeds Conservancy, NAGP is surveying at a national level breed populations, performance levels and population structure. This information will establish a baseline for use in identifying breeds that are or may be approaching "at risk" status. The information will also feed into the Food and Agriculture Organization's global survey of animal genetic resources.

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