

# International Flows of Animal Genetic Resources: An Economic and Biological Analysis

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# Central Questions

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- SOW briefly discusses AnGR trade and gene flow:
    - How significant are current flows of AnGR?
    - What are the magnitudes and directions of these flows?
    - Are there any policy implications?
  - Examine both economic and biological data
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# Trade Data

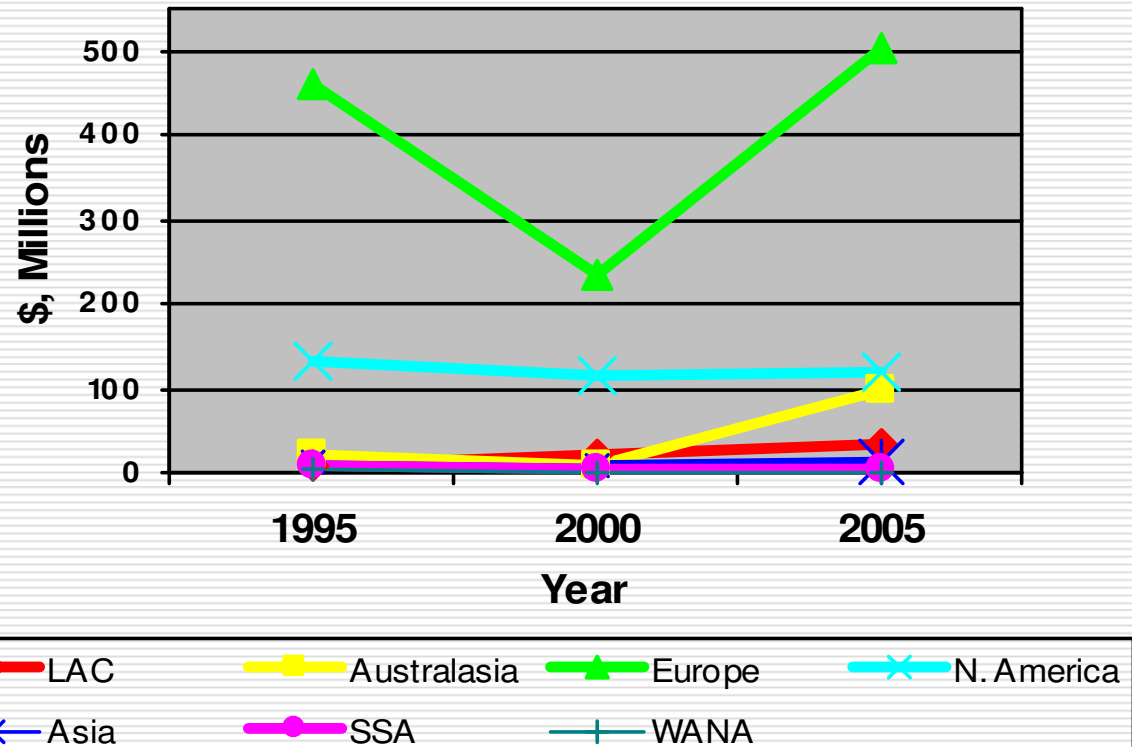
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- United Nations COMTRADE database reports trade from country to country for a number of categories of animal genetic resources.
  - Data on: cattle semen, live cattle for breeding, and live pigs for breeding.
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# Annual world exports by commodity and region

- Live cattle \$300-500 million
- Cattle semen - \$130-180 million
- Live swine - \$30 - 80 million
- Little trend over time

Figure 1. Total Cattle, Swine, and Cattle Semen Exports by Region (LAC: Latin America; SSA: Sub-Saharan Africa; WANA: West Asia North Africa)



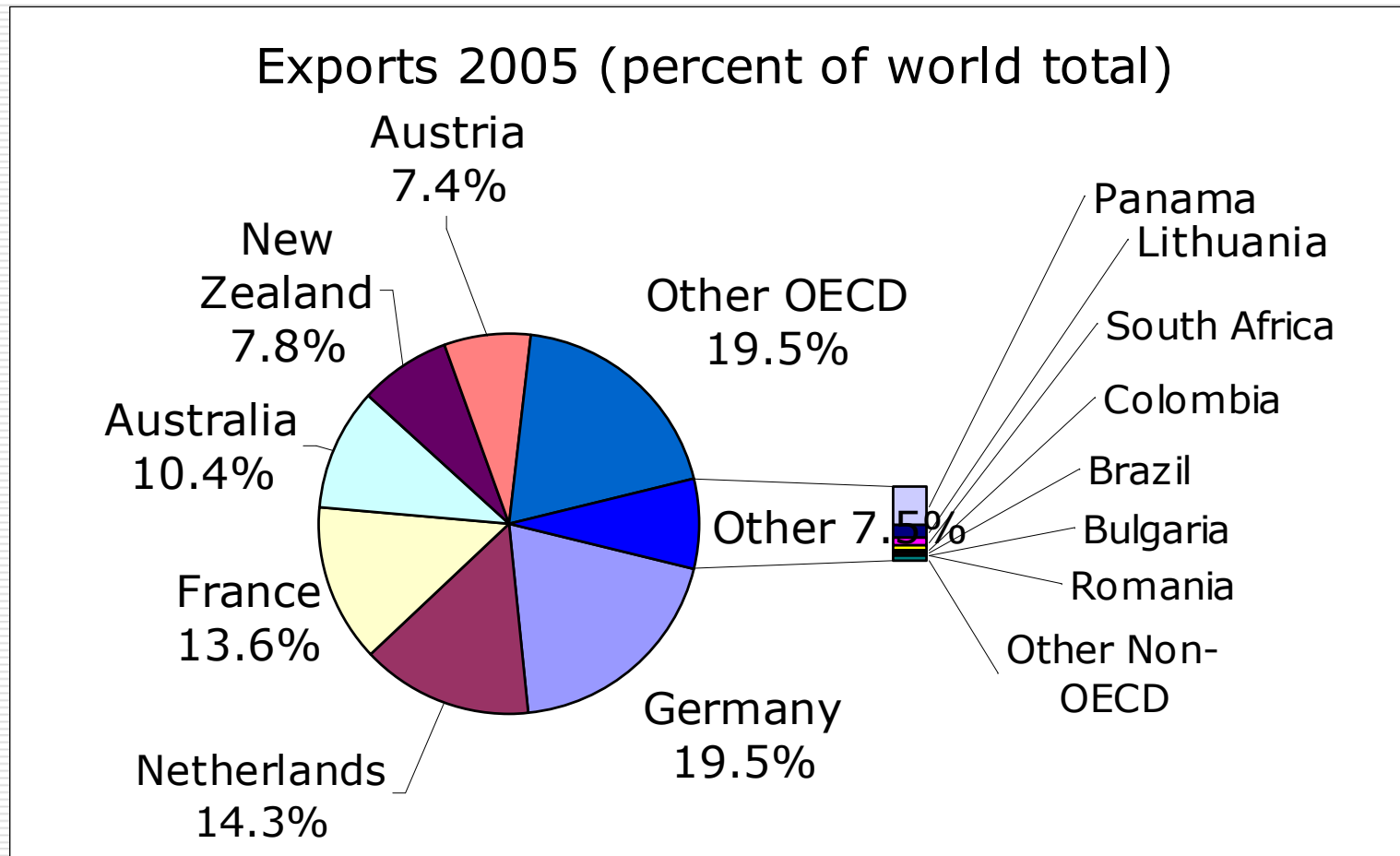
# Leading Exporters

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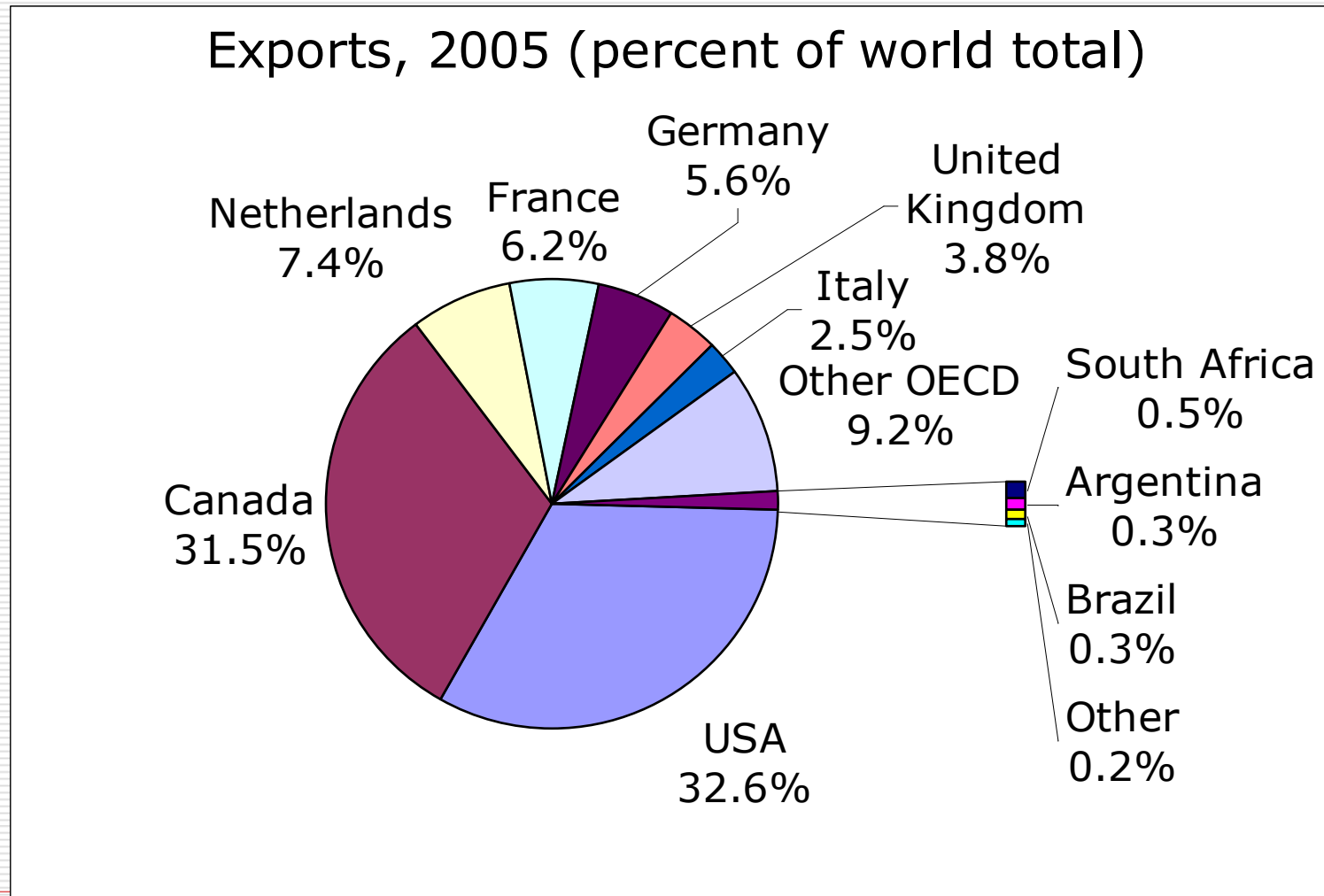
- Global trade in animal genetic resources is dominated by OECD countries.
  - US, Canada, Europe, Australia and New Zealand account for almost all of the commercial exports.
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# Live cattle for breeding: leading exporters

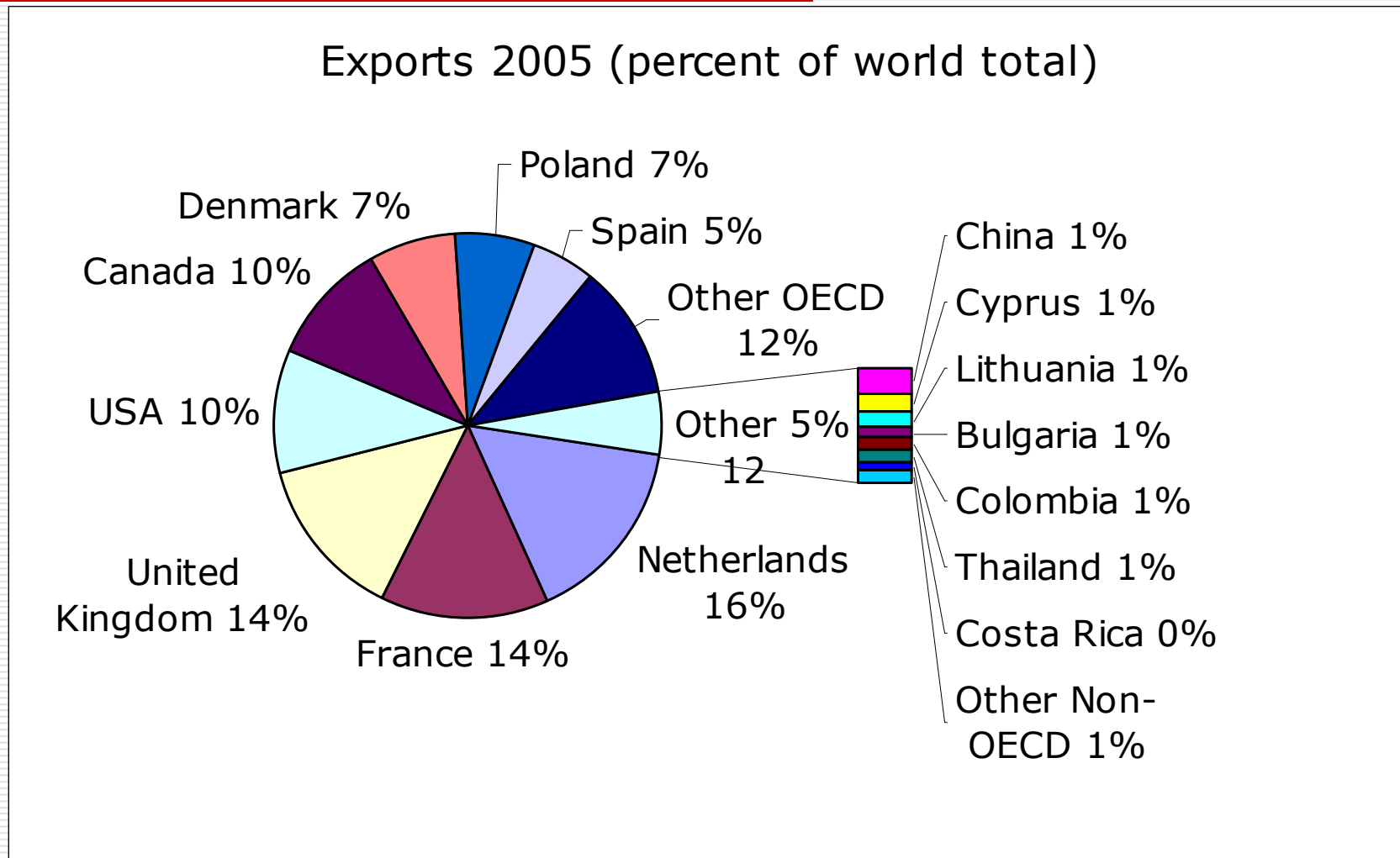
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# Bovine semen: leading exporters



# Live swine for breeding: leading exporters



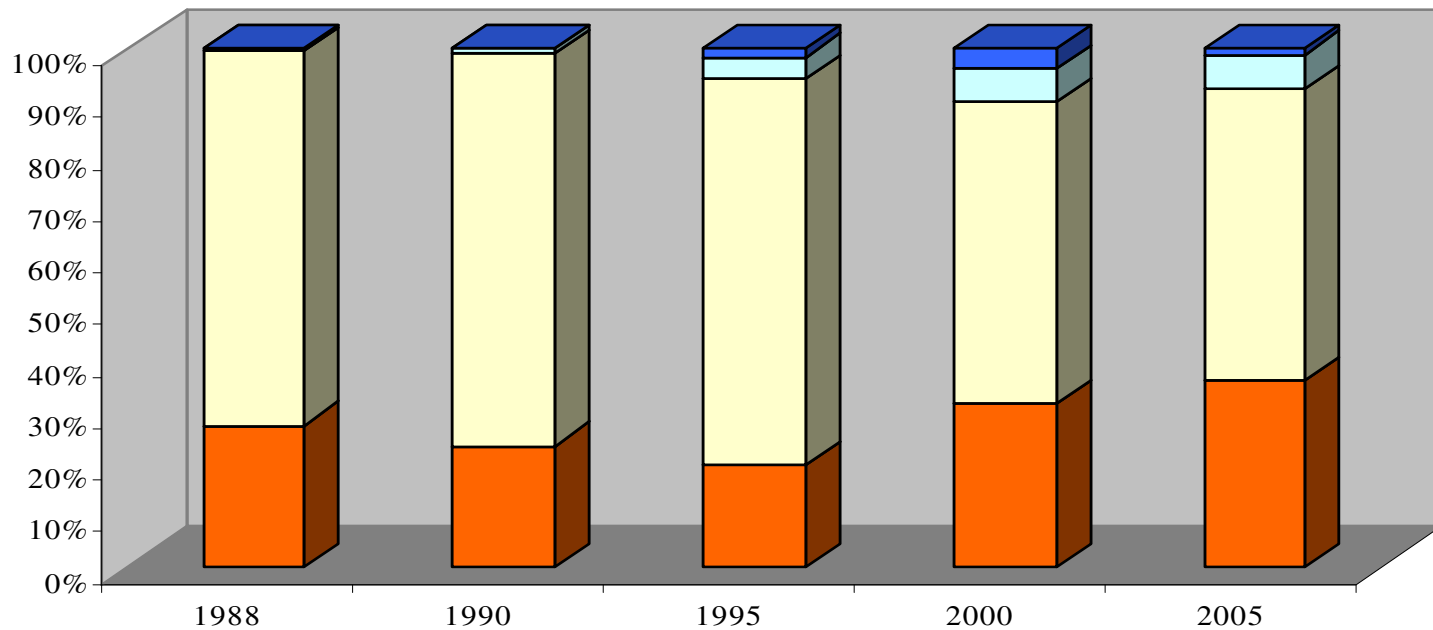
# Direction of Trade

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- Who are the recipients of AnGR exports?
    - Vast majority are OECD to OECD
    - Some flows OECD to Non-OECD
    - Very little flow from Non-OECD to OECD
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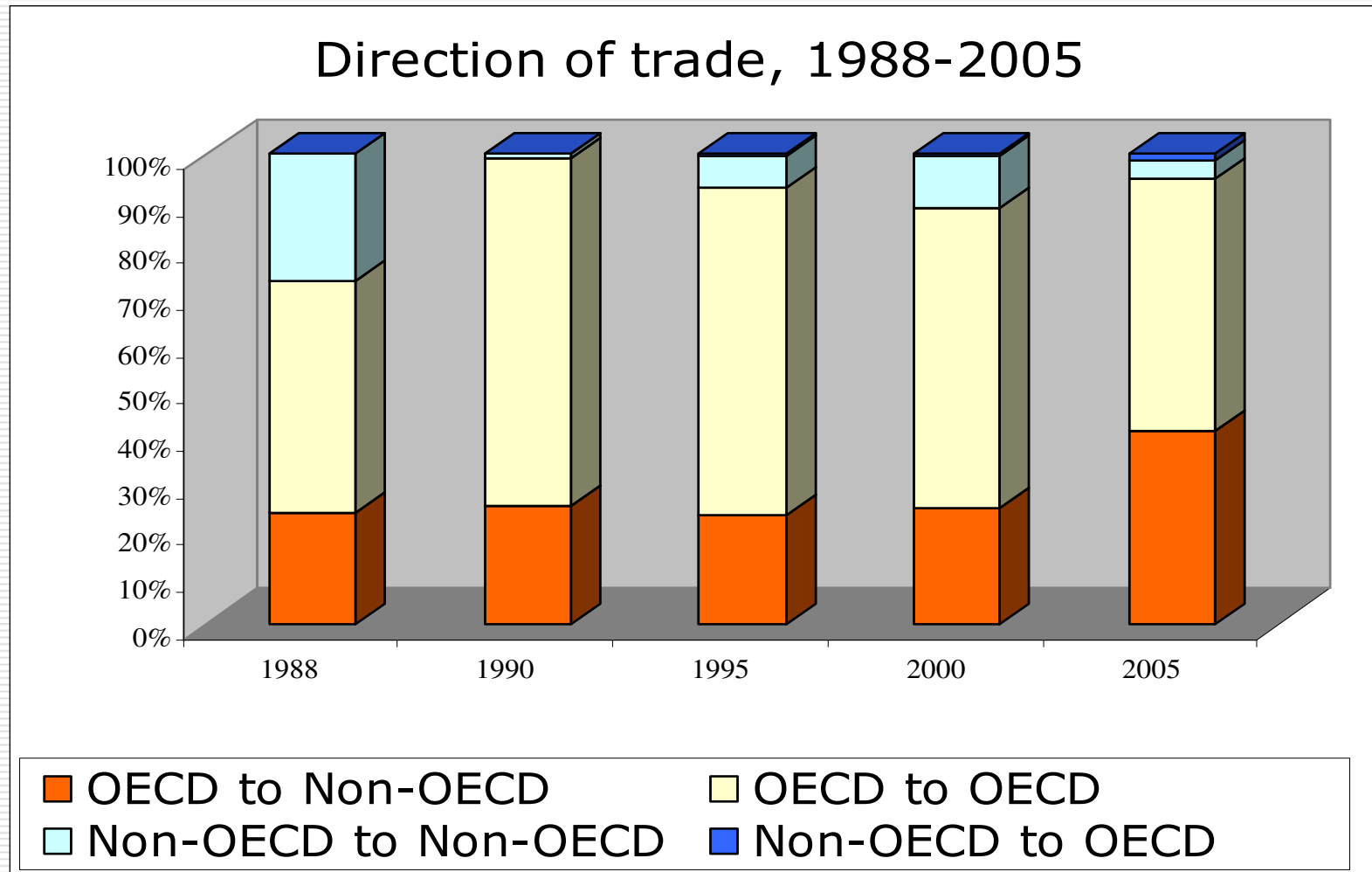
# Live cattle for breeding

Direction of trade, 1988-2005

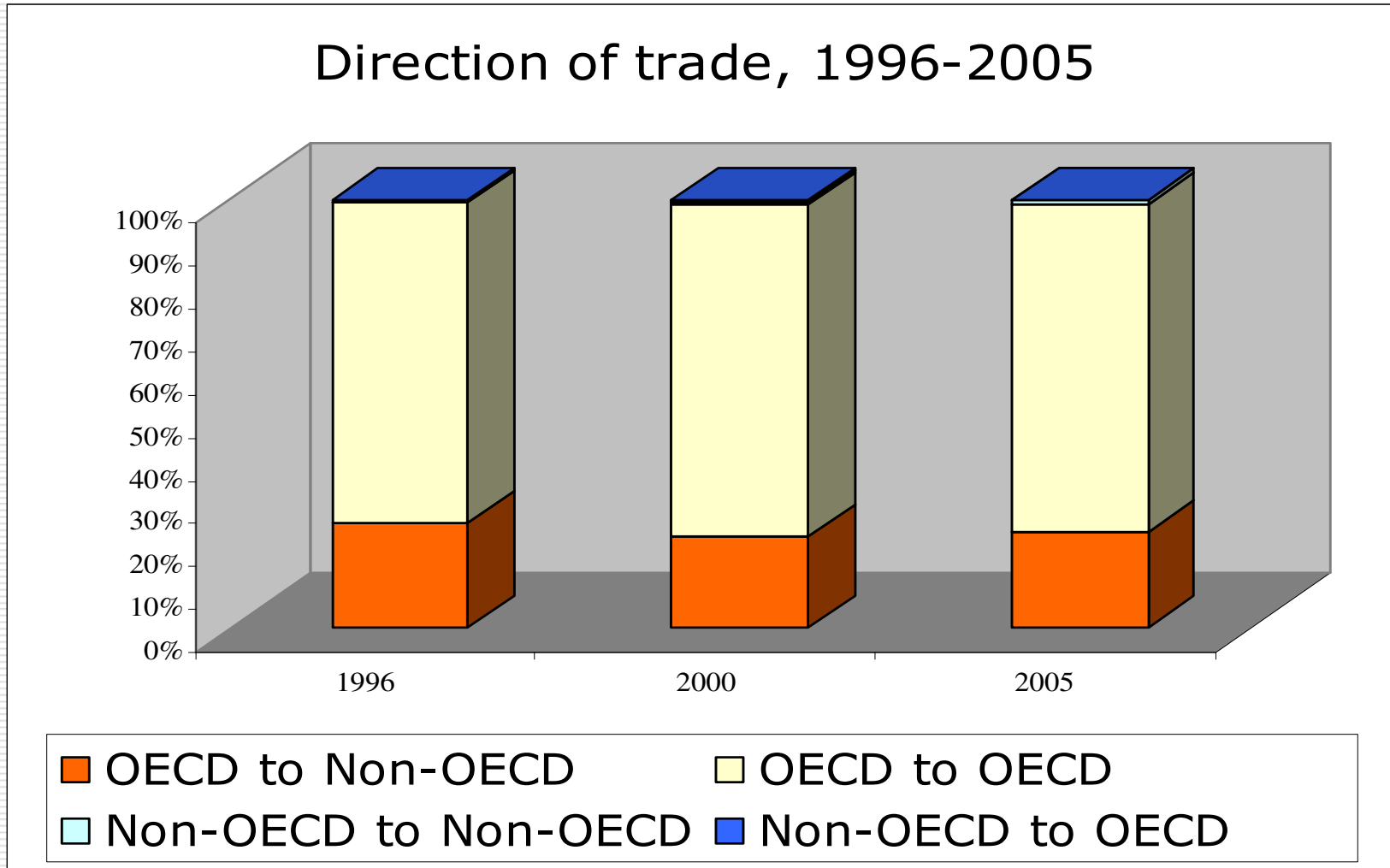


■ OECD to Non-OECD      ■ OECD to OECD  
■ Non-OECD to Non-OECD      ■ Non-OECD to OECD

# Live swine for breeding



# Cattle semen



# Trade Flow Summary

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- The high productivity animal agriculture systems of the world engage in busy and competitive trade in genetic resources.
  - These countries are, in general, sources of genetics for the rest of the world, and
  - They make little use of genetic resources originating in the low productivity systems of the developing world.
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# Genetic Aspects of Gene Flow

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- ❑ Data on breed importation are not kept at the national level.
  - ❑ Some data are available on importations of new breeds.
  - ❑ Pedigree data can be used to shed light on imports within breeds, drawing on records of breed associations.
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# Examples of New Breed Importations

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- In the mid 1980s and early 1990s, a number of breeds were imported to the US from developing countries, with the goal of incorporating them into US production:
    - Meishan pig – prolificacy
    - Tuli cattle – semi-arid adaptability
    - Boer goat – size, growth
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# Meishan

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- ❑ Importation conducted by public sector
  - ❑ Experimentation showed that introgression of prolificacy genes was not an effective strategy
  - ❑ Industry never adopted the breed
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# Tuli

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- Adaptability was not sufficient to offset lower performance characteristics
- Some enthusiasts but no wide spread adoption

<b>Breed</b>	<b>Wn Wt., kg</b>	<b>Tender-ness</b>	<b>Carcass wt</b>
<b>Hereford</b>	<b>240</b>	<b>9.7</b>	<b>350</b>
<b>Brahman</b>	<b>246</b>	<b>13.2</b>	<b>333</b>
<b>Tuli</b>	<b>224</b>	<b>10.1</b>	<b>309</b>

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# Boer Goat

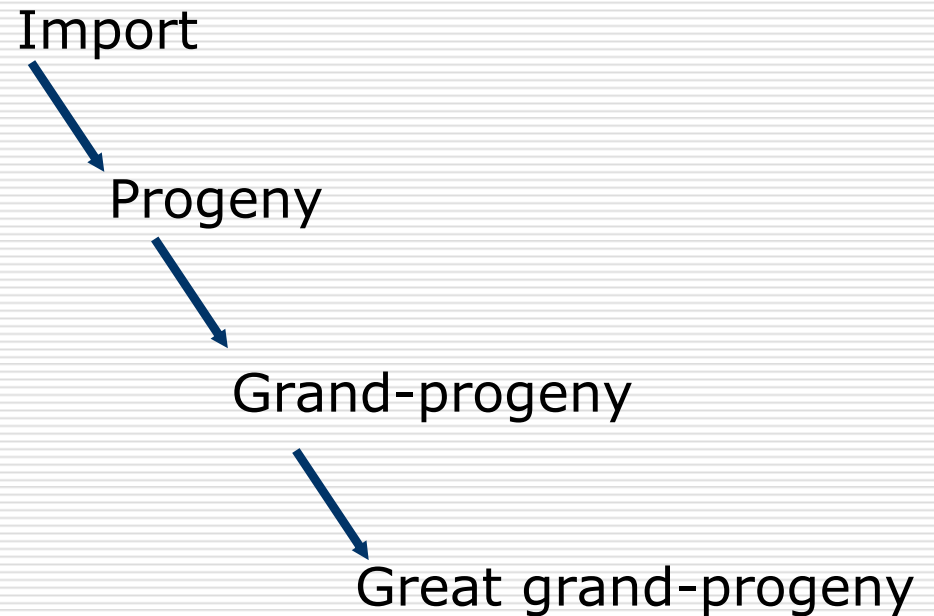
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- Successful importation due to growth & carcass characteristics
  - Producer interest led to successful importation: 45,000 registered in 2000
  - Currently causing a contraction of AnGR for Spanish goats in US.
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# Pedigree Analysis of Gene Flow

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- How prominent do imported genes become?
- Pedigrees from breed associations that have imported animals identified



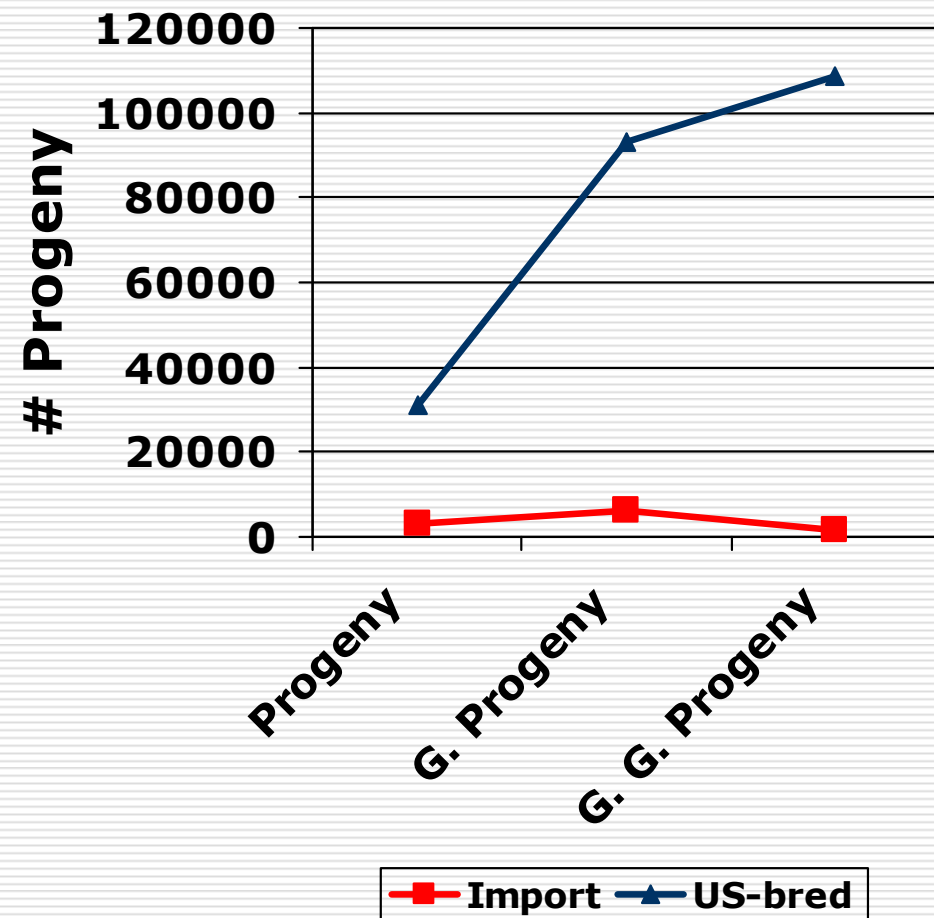
# Imports for a well established competitive breed - Jersey

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□ Since 1950, 186 Jerseys have been imported from 6 countries. Canadian exports excluded.

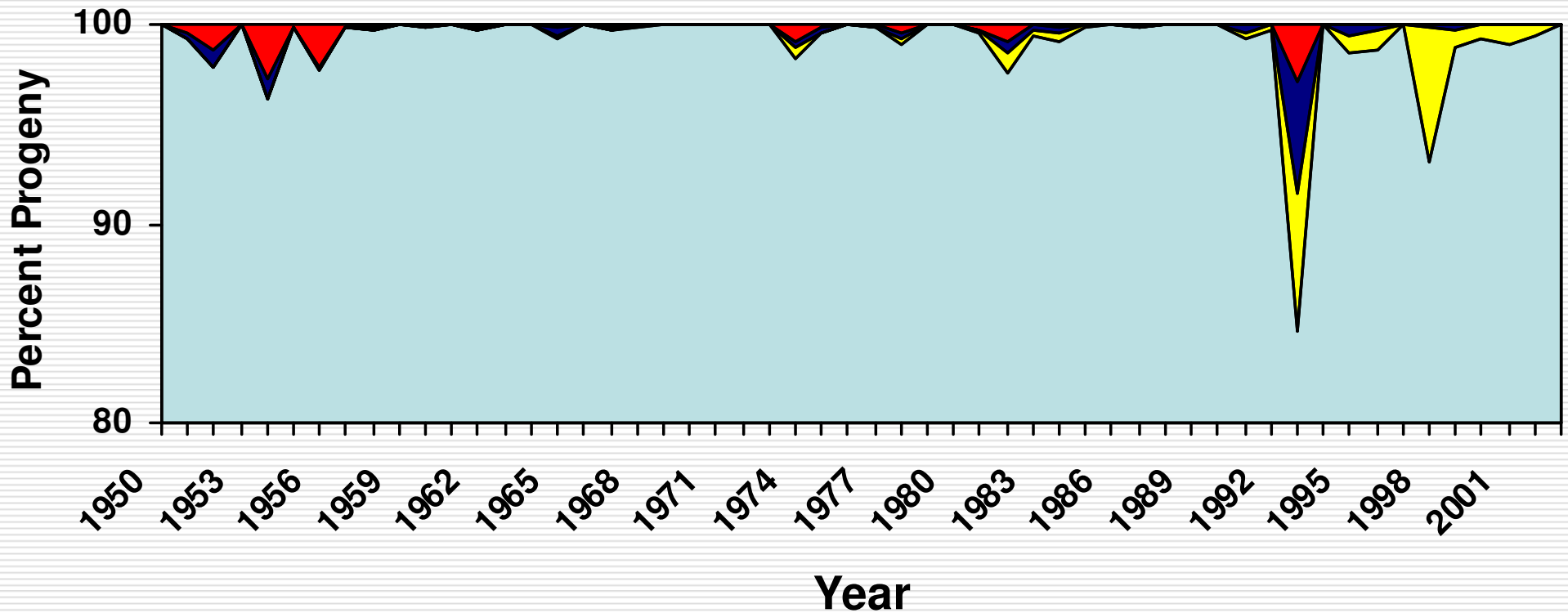
□ 3 generation progeny totals for high bulls:

- Import 10,701
- US-bred 232,494



# Registrations of non-US Jersey animals, by year

Percent of non-US progeny, grand progeny, and great-grand progeny .



# Predicted Transmitting Abilities for High US-bred vs Imported Bulls from 1980 to 2005

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<b>Source</b>	<b>Milk</b>	<b>Productive life</b>
<b>Imported</b>	-326.8	+0.05
<b>US-bred</b>	+194.5	+0.07

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# Future Trends

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- In the near, medium and potentially long term, OECD-OECD exchanges will dominate AnGR trade as breeders take advantage of existing genetic progress. Current market structures will facilitate such trade.
  - There will be few commercial flows of genetics from non-OECD countries to OECD markets. By contrast, high-performance production systems in non-OECD countries will continue to use genetics from OECD sources.
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# Conclusions

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- ❑ Producer involvement is necessary for successful exchange of AnGR
  - ❑ Markets for high-performance genetics appear to be functioning and vibrant
  - ❑ There seems to be little incentive for OECD producers to seek non-OECD genetic resources for importation
  - ❑ Given the small trade volume from non-OECD to OECD, benefit sharing mechanisms based on such trade would not yield significant financial support for genetic conservation, nor cover the recurrent costs of administration.
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# Conclusions

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- Non-OECD genetic resources may be of occasional interest to OECD producers. But are unlikely to provide a steady source of revenue.
  - Given the substantial costs of negotiating benefit sharing mechanisms, it is questionable whether this should be a priority for genetic conservation.
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