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TECHNICAL ITEM II

New World Screwworm (Cochliomyia Hominivorax) and its Economic Impact on the Affected Countries

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18/11/2024

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1. Conceptual foundations

Economic impact assessment is an analytical method that estimates the effects that a given phenomenon has on the welfare of society. For example, it looks at the direct and indirect economic effects of a project, policy, programme, or event on a local, regional, or national economy. The theoretical foundations are found in the benefit-cost analysis, a methodology that quantifies the changes in the welfare of society (benefits) based on the resources used (costs) to produce this change. An extension of this analysis is the evaluation of the economic impact of animal diseases. Through this evaluation, the economic repercussions of diseases affecting animals are measured at various levels of the economy. This type of assessment is essential to understand the impact of animal diseases on agricultural production, food safety, public health, and the income of individuals and communities that depend on livestock or other related sectors.

1.1. Considerations when assessing the impact of a disease

There are two important aspects to bear in mind when it comes to the impact of animal diseases. The first is that the impact of a disease depends on its prevalence and the fact that it can even have an impact when the agent or the disease does not exist in the country or geographic area. In other words, a disease has an effect by its presence as well as by its absence. The presence implies losses due to the disease itself and the resources allocated to control it; the absence implies losses due to the use of resources to prevent the disease from entering. The second aspect is that a disease can have impacts throughout the value chain and these impacts can be very different. For example, it can cause animal mortality and, at the same time, fear among consumers.

Therefore, the economic impact becomes evident in multiple ways, the first being, undoubtedly, the reduction in productivity or the death of affected animals, followed by the costs related to the use of treatment and preventive health measures, the loss of products and the costs of containment or prevention measures throughout the chain. Very often, they end up affecting both national and international markets by drops in demand driven by fear of consumption and trade restrictions resulting from preventive measures. The economic assessment therefore implies estimating the impact that a given disease has on the efficiency of the use of production resources, the efficiency in obtaining products and services, and the welfare of society as a whole.

The economic assessment of a disease not only allows the total losses produced to be known, but also the marginal changes in losses resulting from changes in its prevalence produced among other new outbreaks or by the implementation of control or eradication programmes.

The purpose of impact assessment is to support decision-making in resource allocation, since quantifying costs and benefits allows streamlining the use of resources. In practical terms, it allows veterinarians to explain the scope of diseases to public (Ministry of Finance) or private (managers of livestock) decision-makers, by presenting the background in monetary terms, i.e. understandable to them, and measuring a wide range of private, social, and environmental effects.

1.2. Methodological approach

In animal health economics, cost-benefit analysis (CBA) is a methodology used to compare the benefits and costs of two health situations. Most common comparisons are:

Situation with disease versus without disease: this difference estimates the impact of entry of the disease into a region, country, or farm;

Situation without disease versus with disease: this difference estimates the benefits of eradicating a disease from a region, country, or farm;

Two situations with different prevalence: this difference estimates the benefits of controlling or losses from disease progression in a region, country, or farm.

In all of these situations, investments and costs associated with control, eradication, monitoring programmes, etc. can be included in order to assess their cost-effectiveness.

From a methodological point of view, the impact assessment of diseases presents several challenges. The first is the correct identification of costs and benefits, since it requires systematising all the resources whose use or exploitation is affected by the presence or absence of the disease. The second is the assessment of costs and benefits, which entails determining the quantity and value of the resources affected. The third challenge concerns the timing and time horizon of costs and benefits. This refers to how these costs and benefits evolve or change over time. The fourth is the robustness of the estimates, that is, how reliable and resistant the estimate is to variations in the assumptions or data used in the analysis.

1.2.1. Identification of cost and benefits

There are many ways to classify and systematise the benefits and costs of a project and, regardless of which model is used, the results will be the same if the same evaluation criteria are used. Personally, I agree with the classification of economic effects in three ways1. At this point it should be highlighted that, in economic terms, reducing a loss (cost) is a benefit (income) and, conversely, reducing a benefit (income) is a loss (cost). The categories proposed by experts are:

- **Direct losses:** They are caused by the pathogenic agent and therefore only exist when the disease is present (it is prevalent). Some of the most important direct losses are:
    - Loss of inputs or production factors; for example, death or abortion;
    - Loss of efficiency due to alteration of the production process; for example, slower growth due to digestive disorders or fewer offspring due to reproductive disorders;
    - Loss of products, whether in terms of quantity or quality, due to mastitis, broken eggs or parasites that can be found in meat and internal organs.
- **Indirect losses:** all the resources used or lost resulting from the decisions of people given the existence of the disease, whether it is prevalent or not. In this field, three types are recognised:
    - Additional costs due to measures taken to avoid or reduce direct losses, e.g. treatments, biosecurity, hygiene and disinfection, quarantines, or training;
    - Inefficient use of productive resources due to market or production restrictions, e.g. restricted access to markets, higher costs for purchasing “free of” inputs, and restrictions on the use of technologies or genetics not appropriate to the health condition;
    - Welfare losses essentially, either to the loss of quality of life (due to zoonosis) or to higher production costs and therefore higher prices.
- **Control expenditure**: resources used or lost resulting from the decisions of people, but unlike indirect losses, are of a transitional nature. These costs are necessary to change the epidemiological situation (control or eradication) and, in terms of impact, reduce direct and indirect losses. These costs include all resources used in control and eradication campaigns, from vaccination and quarantine to destruction of animals and staff training.

1.2.2. Evaluation of costs and benefits

The evaluation is quite simple. Only the quantity of resources allocated and their price are required. However, those magnitudes are not always easy to obtain.

It may be relatively simple to estimate the number of dead animals, but estimating the impact of sub-clinical diseases on growth or production certainly is not. In addition, the impact can be very different in extensive or intensive production systems, and the quality of the information will always depend on the system. Without going into detail, estimating the number of resources lost or used often requires the use of statistical methods, very precise data or simulation models.

[1] Otte, M.J. and P. Chilonda. sf. Animal health economics: An introduction. Animal Production and Health Division, FAO

The same applies to the variable of price. It is simple when there is a market for that resource, in which the price is the result of the interactions of supply and demand. But what happens with goods that do not have a market? For example, a pregnant cow, a newborn offspring, and, in general, any resource that is in the process of production (“not finished”) or that cannot be sold (a pasture not being used anymore). Again, assumptions will have to be made to estimate its price taking into account, for example, costs incurred, opportunity cost or some estimated market value.

1.2.3. Timing and time horizon

Diseases are dynamic by nature and so are their impacts. Including these effects in the evaluation expresses the need to pair the economic evaluation model with an epidemiological model, which simulates the progress or decline of the disease based on the presence or absence of control expenditure.

1.2.4. Robustness of the estimates

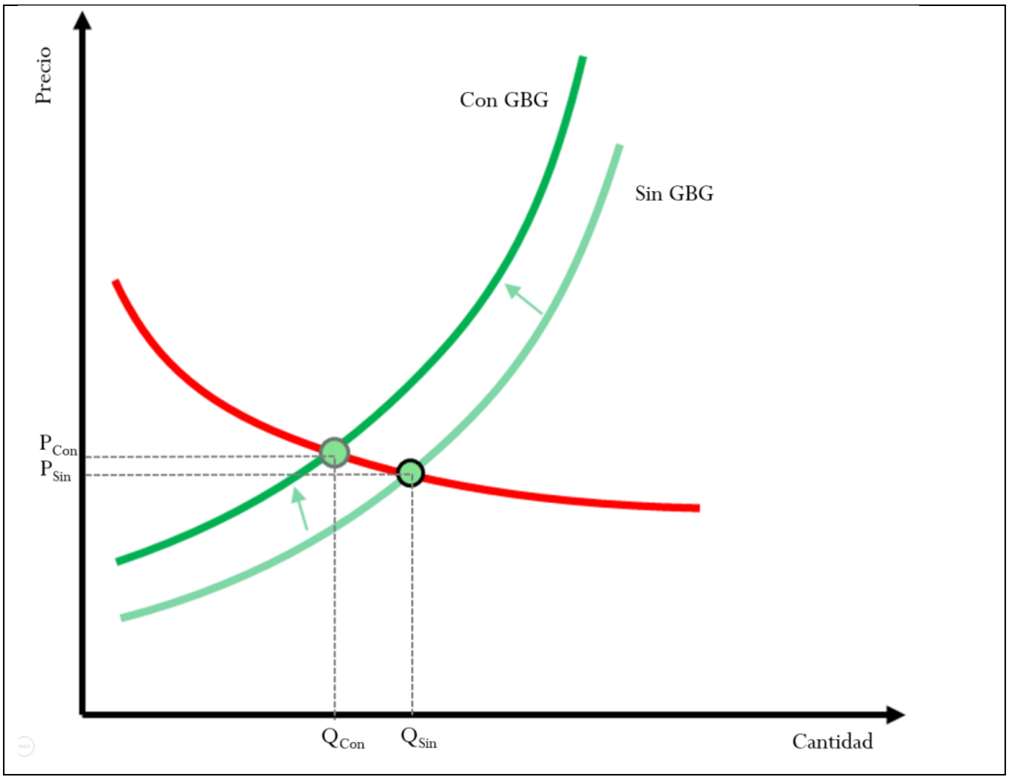
It is not necessary to explain that the impact estimations are not very robust. The biological nature of several variables involves significant levels of uncertainty. Variations in production systems, agroecological conditions, climate, the agent itself and the affected animals can produce important changes in the impact estimations. It is therefore very important to make efforts to improve the robustness of the results. This is achieved, first, by promoting a continuous effort to generate better data that can be used in evaluation models. The second is to perform simulations or sensitivity analysis to see how variations in the model parameters affect the results. This same analysis also allows to determine which variables have the greatest effect on the results in order to find better estimators for these variables.

1.3. Aggregate effect on social welfare

A final aspect to consider when discussing the economic impact of a disease is its effect on the welfare of society as a whole (province, country or region), which can be explained by analysing the effect of a disease on the so-called producer and consumer surplus, for instance. Producer surplus represents the welfare obtained by livestock producers. **Error! Not a valid bookmark self-reference.** shows this surplus by the area between the supply curve (in green) and the balance price line in the absence of the disease (Psin). Similarly, consumer surplus, which reflects the welfare obtained from the consumption of livestock products, is represented by the area between the demand curve (in red) and the same balance price line. To understand how the welfare of consumers and producers is affected, we must see what happens to this surface when the New World screwworm (NWS) fly enters. It affects all farmers, regardless of their efficiency or production size, causing a general increase in production costs and is shown in **Error! Not a valid bookmark self-reference.** (a shift of the supply curve upwards and to the left). The shift shows that all producers and farmers face higher costs to produce a given quantity of products. Faced with an unchanged demand, this shift in supply results in an increase in the equilibrium price, which without NWS is Psin* and due to its presence increases to Pcon**. This price increase reduces consumers' welfare, since now the area that represents their surplus is smaller, being the area comprised only between the demand line and the new price (Pcon).

For farmers, even if the price is higher, the quantity sold decreases. However, the combined effect of both still represents a loss of welfare for farmers. That is, although the livestock sector suffers the economic loss, part of that loss is passed on via prices to consumers, as reflected in the figure.

Figure 1 Effect of NWS on the supply curve, the balance price and producer and consumer surplus



* Psin: Pwith

** Pcon: Pw/o

If the effect of trade is added to this analysis, two considerations must be taken into account. In the case of livestock sectors with a significant call for **export**, the demand curves are less flexible (more horizontal), which means that farmers cannot pass on these losses to the consumer in a significant way. This means that the loss of welfare is almost entirely borne by farmers. In the case of sectors in which a significant part of consumption is **imported**, the supply curve will be more flexible (horizontal) and farmers will not be able to transfer their costs to consumers. In both cases, the most inefficient farmers, those who produce at higher costs, will not be able to continue producing; it is usually farmers who cannot take advantage of economies of scale, i.e. those with fewer animals.

Fortunately, New World screwworm has little or no impact on consumer preferences, meaning that the demand curve does not shift downwards. If it did, its impact would be much more serious, as there would be a significant drop in prices and quantities produced, with a welfare loss for both consumers and farmers. Salmonellosis, bovine spongiform encephalopathy and avian influenza are examples of diseases that do cause such shifts in demand.

2. Economic impact of New World screwworm

2.1. Cause of the losses from New World screwworm

In order to analyse the losses from New World screwworm, it is essential to clearly distinguish between the species and types of animals affected. Firstly, all animal species with productive value, such as cattle, poultry, pigs and horses are included. A second group consists of pets, such as dogs and cats. There are also losses caused to human health due to infestations in people and, finally, infestations in wildlife.

The following sections of this report will focus essentially on losses in farm animals, since losses in pets and in public health are difficult to assess and losses in wildlife are largely unknown. There is insufficient background data to estimate the losses or damage that NWS causes in wildlife and even less to estimate the economic value of such damage.

2.1.1. Direct losses

Following the proposed typology, NWS causes two types of direct losses. Firstly, the infestation increases discomfort which affects feed intake and therefore reduces the live weight of the animals. Secondly, once secondary contamination leads to septicaemia, the animal dies, leading to a total economic loss. Since cases of spontaneous healing of affected animals have not been described, the result is always death, which means the initial weight loss is irrelevant in economic terms.

The extent of the losses will depend on several factors:

- Species affected: although precise data are not available, the NWS fly appears to be most attracted to cattle, sheep and goats;
- Age of the animal: a higher incidence is observed in new-born animals, particularly in the form of umbilical myiasis (immediately after birth), followed by myiasis in animals of any age due to injuries during routine procedures (dehorning, identification, tail trimming, etc.) and accidental wounds;
- Production system*: although infestations appear to be more common in extensive systems, it is difficult to determine whether this is due to fly behaviour or to less intensive monitoring of animals and less use of preventative treatments (which also generates indirect costs).

It should be noted that this report focuses on economic losses, leaving aside any ethical aspects related to the obvious loss of animal welfare. Any infestation causes great discomfort and, if untreated, causes pain and, ultimately, death.

2.1.2. Indirect losses

Indirect losses are those generated by human actions in response to the presence or possible entry of a disease. They can be extremely relevant due to the all-or-nothing condition that implies the total loss of the animal when no action is taken in time. In the case of NWS, indirect losses include:

- **Preventive treatments:** they consist of cleaning, disinfection and application of insecticides in areas susceptible to infestation. Costs include the use of inputs and the workforce required to carry out the procedures. In addition, the extend of these losses will depend on factors such as the production system and routine procedures (dehorning, identification, etc.);
- **Curative treatments**: in case of infestation, treatments include cleaning and disinfecting infested wounds. These treatments require both inputs and workforce for the surveillance and identification of affected animals, and their subsequent capture and treatment, which increases costs in comparison to preventive treatments;
- **Production adjustments**: these are the measures farmers apply in order to reduce the likelihood of infestation. They include carrying out specific types of management during periods when the number of flies is lower, such as changing the calving season to an earlier period, thus avoiding infestations peaks. However, these measures often result in a loss of production efficiency;
- **Losses in value**: this refers to a price drop due to a decline in the quality of animal products. It includes a lower value of hides due to injuries, delay of the marketing of an animal or product due to the use of treatments that require certain storage periods before consumption (e.g. insecticides or antibiotics).

2.1.3. Control expenditure

The re-emergence of NWS in Central America has raised the awareness of the costs involved in its control. These costs include supporting the strategy of releasing sterile flies in regions east of Darien, as well as their transfer to other Central American countries. Taking the example of the Regional Containment and Eradication of the New World screwworm project in OIRSA member countries, the objectives—and related costs—include:

- Expansion of surveillance activities;
- Strengthening education and outreach to veterinarians and animal health technicians;

- Strengthening regulatory controls on animal movement;
- Improving technical capacity for preliminary identification of NWS;
- Promoting the use of the sterile insect release technique.

In other countries, efforts include, among other measures, developing and implementing communication protocols, regulations and emergency response exercises, coordinating with health and environmental sectors, and strengthening the capacity to detect infected animals.

3. Impact of New World screwworm (NWS) on Uruguayan livestock

In this section, I will present some methodological details and the results of the **"Economic Feasibility Study for the Eradication of the Myiasis Caused by the New World Screwworm in South America"**[2]. The goal is to show the main variables that influence the extent of the impact and to identify the key factors that determine the economic losses incurred, both in Uruguay and in other countries.

To provide context, livestock farming is a very important economic activity that occupies more than 80% of the Uruguayan territory, with a herd of about 12 million cattle and between 6 and 6.5 million sheep. Every year, approximately 550,000 tons of beef and 170,000 tons of lamb are produced, of which nearly two thirds are exported to more than 100 countries.

The myiasis caused by the New World screwworm (NWS) represents a major production and economic issue. Considering the seriousness of this disease, farmers in affected areas invest considerable human and financial resources in the prevention and treatment of myiasis in cattle and sheep herds, especially during the summer. The main actions include daily monitoring of livestock, especially of the most vulnerable animals (such as new-borns), immediate treatment of injured or infected animals, and preventive use of antifungals or endectocides. In 1998, the Directorate General of Livestock Services (DGSG) of the Ministry of Livestock, Agriculture and Fisheries (MGAP) of Uruguay estimated that direct annual losses at USD 36.5 million, while Wyss (2000) estimated them at USD 147 million per year and for the industry at USD 1,178 million[3]. In 2006, the DGSG estimated a total loss of USD 48.8 million[4].

3.1. Loss analysis

To measure the socioeconomic impact caused by the NWS, a simulation model was built in an Excel® spreadsheet that calculated the direct losses (caused by the worm) and the indirect losses (resources used or lost due to decisions made by people). As for the methodology, it involved identifying, quantifying and estimating the following losses in different situations:

- Direct losses
  - Due to livestock mortality caused by untreated myiasis, considering species (bovine and sheep) and animal category (young or adult animal)
- Indirect losses
  - Due to preventive treatments carried out after birth or in response to injuries caused by cruel handling by species, category and type of handling;
  - Due to surveillance to identify exposed or infested animals by species and farm size (hectares of land);

[2] **Köbrich, C.** 2020. Economic feasibility study for the eradication of myiasis caused by the screwworm in South America. Working paper prepared within the framework of the IAEA Regional Technical Cooperation Project RLA5075 "Fortalecimiento de las Capacidades Regionales para la Prevención y el Control Progresivo del Gusano Barrenador del Ganado". 58p.

[3] **Wyss, JH.** 2000. Erradicación del Gusano Barrenador del Ganado en las Américas. Conf. OIE 2000, 245-251.

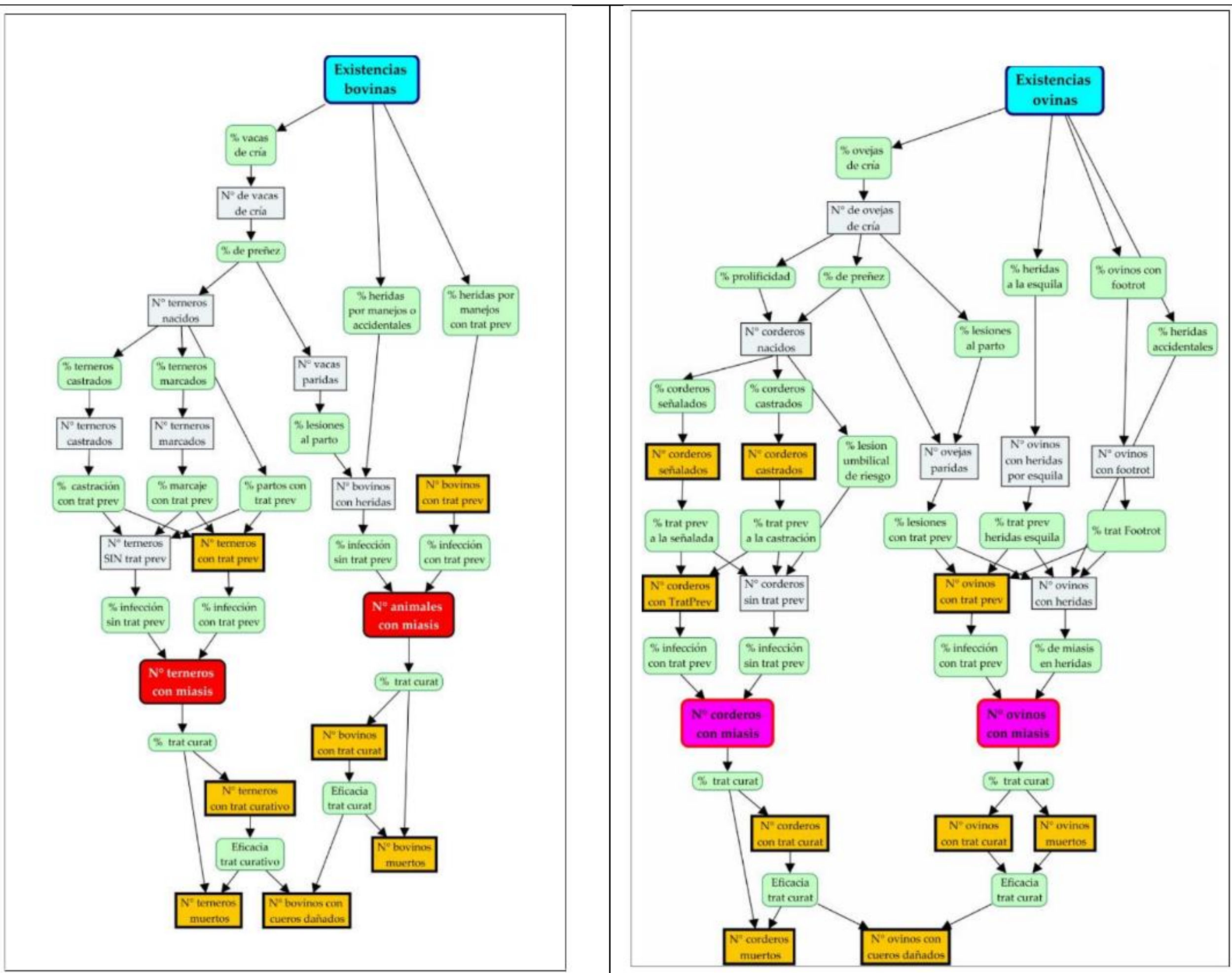
[4] **Hernández, A y J Piaggio**. 2015. Situación del GBG al 2015 y antecedentes sobre el impacto socioeconómico de su presencia en el Uruguay. Paper presented at Reunión Regional para identificar los contenidos del estudio para la determinación del impacto socioeconómico del Gusano Barrenador del Ganado Cochliomyia hominivorax (GBG) en Brasil, Ecuador, Panamá, Paraguay, Perú y Uruguay. Asunción Paraguay, agosto 2015.

- Due to curative treatments in animals with myiasis, considering species and category;
- Due to loss of value of skins by species and category.

Model flows are shown in Figure 2 a and b and were used to estimate the losses on Uruguayan cattle and sheep herds as well as the animals in Argentina and Brazil that would be less than 50 km from the border, i.e. almost 14 million cattle and 7.6 million sheep. Table 1 shows the number of animals affected per year according to these models. Source: Köbrich (2020)

Table 2 presents the loss estimate, i.e. the assessment of deaths, treatments and surveillance activities described in Table 1. Besides the relevance of the losses regarding the number of animals affected and their extent, some key aspects for the estimation of losses in other countries should be highlighted.

Figure 2 Schematic of the variables used to estimate losses due to NWS myiasis in cattle in Uruguay



a) Cattle

b) Sheep

Source: Köbrich (2020)

Table 1 Stocks, treatments, myiasis and mortality of animals in Uruguay by species (thousands of heads)

	Cattle	Sheep
Cattle	13,930	7,626
Breeding females	4,987	4,110
Young animals with preventive treatment	3,695	0
Identified young animals with preventive treatment	3,695	2,437
Castrated young animals with preventive treatment	1,663	1,462
Young animals with myiasis	408	376
Young animals with curative treatment	404	301
Young animals dead from myiasis	8	90
Injured animals with preventive treatment	167	1.115
Animals with myiasis	51	45
Animals with curative treatment	50	91
Animals dead from myiasis	1	27

Source: Köbrich (2020)

Table 2 Value of losses caused by NWS in Uruguayan livestock by item and species (thousands of USD)

Item	Cattle	Sheep	Total	%
Preventive treatment in young animals	4,406	1,251	5,656	11.1
Curative treatment in young animals	658	246	904	1.8
Loss due to death of young animals	942	4.509	5.451	10.7
Preventive treatment in the herd	175	543	718	1.4
Curative treatment in the herd	166	149	315	0.6
Loss due to death of animals in the herd	462	1.564	2.026	4
Loss of value of hides or skins	871	316	1.188	2.3
Workforce (fixed component)	22,493	12,313	34,806	68.2
Total	**30,173**	**20,891**	**51,064**	**100**
%	59.1	40.9	100	

Source: Köbrich (2020)

The relationship between the herd size and the extent of losses is the first thing to highlight. In terms of stock, for every sheep there are 1.8 cattle. However, in terms of economic losses, for every dollar lost in the sheep sector, the cattle sector loses 1.4 dollars. This is mainly because sheep farming is more extensive, which implies less supervision and monitoring during births and thus less coverage of preventive and curative treatments. As a result, the number of sheep dead from NWS is significantly higher than the number of cattle. Otherwise, it is also possible that the losses in cattle due to preventive and curative treatments are higher than in sheep because these indirect costs allow the reduction of direct costs (mortality).

The second important aspect is the structure of the losses, i.e. the relationship between the different items shown in Source: Köbrich (2020)

Table 2. First, there are the fixed costs related to herd monitoring, whose objective is to identify infested animals on time. This is very important as it shows that the amount of time (work) devoted to cattle supervision is a major source of loss. This issue highlights a second aspect; specifically, a low-skilled job paid a low wage. At first glance this may be seen as something positive, as it creates jobs for people with low employability. However, in the medium term this is not the case, because it is expected that as a country develops, these jobs will become less in demand and, therefore, more difficult to fill. In other words, as a country's income increases, workforce losses will continue to grow significantly. These losses are followed by the costs related to the deaths of young animals, especially sheep, and to preventive treatments, which are substantially higher in cattle, since, being more valuable, this species benefits from greater monitoring.

A third aspect is the high degree of uncertainty regarding the epidemiology and management implemented by farmers to face the NWS. The lack of data on the value of parameters used in the simulation models clearly demonstrates this. To assess the robustness of the results, the technical parameters of the model were tuned to relatively narrow ranges (+/- 2.5%) with the aim of identifying variables with the greatest impact on the economic indicators of the programme. However, this range is not directly related to the uncertainty about the real value of the parameters. Therefore, using objective values from field tests or scientific studies could significantly modify the economic results.

Therefore, NWS myiasis is definitely a serious problem for cattle and sheep farming in Uruguay. However, or perhaps precisely because of this, the scientific and technical background available to assess the impact of NWS and the cost-effectiveness of its eradication is, at the very least, limited. However, there are also other effects that could not be included in the simulation model, which would undoubtedly increase losses. They include:

- The impact of the NWS on production management, as many farmers adjust management dates (calving, shearing, etc.) according to absence of the flies, instead of doing it at the most appropriate time of the year. This affects the productivity and economic efficiency of the production systems;
- Both mortality reduction and changes in management dates affect the structure of the herd and, therefore, its productivity;
- The later a curative treatment for myiasis is applied, the greater its impact on weight gain and future condition of the animals, especially in lambs (a cost that could not be considered);
- The unquantified loss resulting from weight reduction and loss in production of milk (when animals are infested with NWS);
- Having information to simulate these effects and be included in the assessment would improve the quality and robustness of results. The values of the technical variables used are particularly critical.

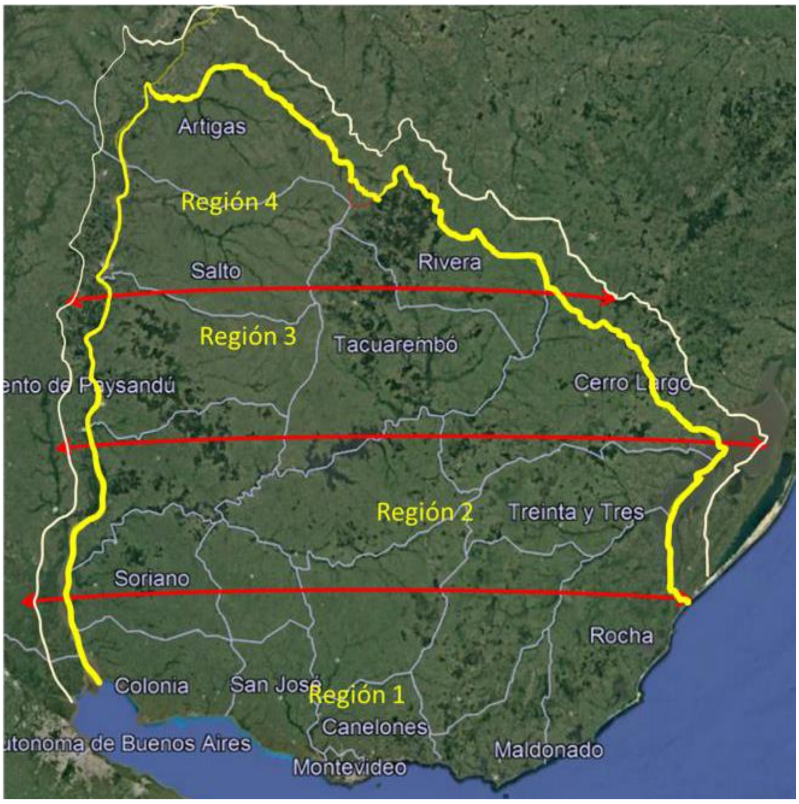
Finally, from a social perspective, the losses and, therefore, the benefits of controlling or eradicating NWS are mostly private, suggesting that the livestock sector should actively participate in the implementation of these measures. However, since the causative agent (the NWS fly) crosses the boundaries of private farms, it is impossible for this sector to deal with it, which turns NWS into a public health problem.

Having more information to simulate these effects would improve the economic assessment of the initiative, with the values of the technical variables used being particularly important.

3.2. Cost-effectiveness and risk of an eradication plan

Considering the economic losses caused by the NWS fly in Uruguay, it was proposed to evaluate the feasibility of a plan to eradicate this pest in the country. A pilot programme had already been implemented in 2009 on the border between Uruguay and Brazil, using the sterile insect release technique. This programme provided basic information for a control and eradication plan. The strategy proposed in this National New World Screwworm Eradication Programme (PNEGBG in Spanish) would divide Uruguay into four parts and apply a progressive eradication plan from south to north, using the sterile insect technique (SIT). The project would be implemented in sequential operational phases: first, the programme would be established, followed by a pre-eradication phase focused on suppressing populations, then the eradication phase through the release of sterile insects, and finally a post-eradication phase to confirm the complete elimination of the NWS. In addition, containment barriers would be established in each region by releasing sterile insects and achieving eradication in the neighbouring region before proceeding to the next section northwards. Once eradication completed, only one barrier would be maintained along the border with Argentina and Brazil (**Error! Not a valid bookmark self-reference.**). Sterile insects would be purchased from Copeg until eradication in Uruguay completed.

Figure 3 Regions established for the National NWS Eradication Programme in Uruguay



Note: All areas are for reference only

Source: Köbrich (2020)

To assess the economic feasibility of the PNEGBG, a simulation model was developed comparing the current situation to the eradication scenario. In the current scenario, annual losses in Uruguay and border areas amount to USD 51.0 million (Table 2). With an initial investment of approximately USD 4 million and operating costs reaching a maximum of USD 21 million in the fifth year, losses are progressively reduced over a period of nine years. The benefits of the programme, which initially amount to only USD 1-2 million per year, increase significantly from the fourth year onwards, reaching a maximum of USD 51 million from the ninth year onwards. The project has a net present value (NPV) of USD 113.7 million and an internal rate of return (IRR) of 33%. The benefit-cost ratio is 1.87 and the investment pays off in the eighth year.

For this evaluation, a risk analysis to assess the robustness of the results was conducted as well. The analysis shows that in 90% of the scenarios, the NPV is between USD 62.4 and 155.7 million, and the minimum IRR (14%) exceeds the social discount rate (7.5%). From an economic perspective, the project under the evaluated conditions is profitable and its economic risk is low. From a technical perspective, however, there is a high level of uncertainty related to the epidemiology and livestock management of the NWS, because of a lack of quantitative data. The technical parameters in the simulation model were adjusted in relatively narrow ranges (+/- 2.5%) to identify the variables with the greatest impact on the economic indicators of the programme. This range does not necessarily reflect the real uncertainty about the parameter values, so the inclusion of objective data obtained from field tests or scientific studies could significantly modify the economic results.

4. Implications for the current situation

The use of the sterile insect technique over decades has allowed a great deal of experience in the control of NWS to be gathered. In addition, studies provide epidemiological and economic background of the disease. As a result, valuable lessons are available for dealing with this pest in the near future.

The most obvious lesson is that it is possible to eradicate the NWS using this technique. Although this is widely acknowledged by the official Veterinary Services of the affected countries, this is not necessarily the case in the region. In many countries, producers have resigned themselves to coexist with the pest, adapting their practices and bearing the costs of workforce and inputs necessary for the prevention and treatment of NWS. Although some producers are aware that there is a possibility of eradicating this problem, they surely believe the solution is beyond their reach. It is therefore important to keep them updated and educated about the existence and impact of SIT, so that they can put pressure on their governments for the need of an international eradication programme.

The first key message to convey is that NWS causes significant losses, due, firstly, to mortality and, secondly, to the preventive and curative costs that producers must assume to avoid or reduce such mortality. Mortality also has a significant impact on productivity and, therefore, the efficiency of livestock production. A key variable in this sector is the extraction rate, i.e. the ratio between the number of animals slaughtered and the size of the herd. The mortality of young animals is a factor that significantly reduces the extraction rate, which means that a higher number of females is required to produce a given number of young animals. This situation increases the pressure on natural resources, because more land will be needed to maintain the production level.

The extent of losses in sheep and cattle herds depends not only on the number of animals and the environmental burden of NWS flies, but also on the intensity of monitoring and surveillance. In the case of large herds and those using large areas (e.g. in Brazil or Argentina), workforce costs related to surveillance and treatment are high, and late detection of infestations can lead to greater losses. On the contrary, when herds or farms are smaller (e.g. Panama or Costa Rica), applying simpler or more permanent surveillance reduces direct losses, while indirect losses due to the application of preventive or curative treatments will be proportionally greater.

Along the same line, workforce costs, which are a crucial factor in this context, display large variations in Latin America. In 2024, the monthly minimum wage varies from approximately USD 170 in Argentina to USD 680 in Costa Rica. As shown, workforce costs in one country can be up to four times higher than in another, thus increasing losses due to this factor alone.

While these losses are generated in the productive sector, they are also transferred, to different extents, to consumers, causing a loss of welfare for both farmers and citizens. The scope of this transfer depends, among other factors, on the country's commercial strategies. In meat exporting countries, farmers usually must cover most of the additional costs, because they cannot pass them on to consumers due to international competition. As for countries that import meat, farmers must face the pressure of competing with international prices, which in turn prevents them from transferring part of their costs to prices. This situation can lead producers to abandon their productive activity because those costs are not sustainable. From a simple economies of scale perspective, the impact will be higher on small-scale or peasant livestock farming.

Finally, since the NWS fly can travel between 30 and 40 km, it is practically impossible for farmers to establish effective containment barriers. It is thus clear that the management of this pest must be approached through coordinated action between countries, focusing on eradication from Central America and extending to the rest of the South American continent. It is not realistic to believe that a single country can eradicate the NWS fly and keep it outside its borders. As a transboundary pest, its control and eradication can only be achieved through joint action by the different countries, bearing in mind the purpose of a definitive elimination throughout the continent.