DEPOPULATION – REPOPULATION

There are extreme cases where it may be required to depopulate a farm and clean it before repopulating it again, such as an outbreak of a certain foreign animal disease. Depopulation could be mandated by the government. If this is the case, it is probable that the government will pay indemnification for the cattle, and then slaughter and dispose of all the cattle on the premise. Alternatively, the producer may chose depopulation as a management option to clean up a disease. In this case, the producer will likely sell all of the cattle to a slaughter plant and clean up the farm by himself/herself. Note that in both cases the producer receives at least some income – in the first case from the government and in the second, from a slaughter plant. This could have a substantial effect on the price received in one case versus the other. While the indemnification policy and rates will be announced, the government may price the cattle at fair market value as breeding stock. For a voluntary depopulation, the producer will receive cull value at best.

The following article walks a producer and/or consultant through the depopulation – repopulation process and identifies and quantifies the costs associated with both mandatory and voluntary depopulation-repopulation.

We could identify 3 time periods for this practice:

1) Depopulation
2) Quarantine and disinfection of the farm
3) Repopulation

Depopulation

<u>Government mandated depopulation:</u>
In this period the animals are slaughtered and buried. Materials that are potentially contaminated are also buried at this time. The costs identified at this time are:

- Cost to slaughter the cattle
- Cost to bury/dispose of the cattle
- Cost to destroy feedstuffs, manure, bedding and any other contaminated material
- Value of the buried feedstuffs and bedding

The producer will receive revenue from government indemnification for the cattle, feedstuffs and bedding buried.

<u>Producer voluntarily depopulates:</u>
In this period the animals are sold to a slaughter plant and materials that are potentially contaminated are destroyed. The costs identified at this time are:

- Cost to market the cattle (transportation, commissions, etc..)
- Cost to destroy feedstuffs, manure, bedding and any other material that could be contaminated
- Value of the buried feedstuffs and bedding

The producer will receive revenue from selling the cattle.

The net cash flow for the depopulation period is the difference between revenue from the market or government indemnification and the cost to destroy animal, feedstuffs and materials. Depending on the revenue received, this may be a positive cash flow because the producer is selling breeding stock as well as market stock like calves or cattle on feed.

Quarantine and disinfection of the farm

During this period, the farm remains empty of cattle, cleans up and disinfection practices are applied. Costs are similar for both government mandated and voluntary depopulation situations:

- Downtime cost. This is the value of the expected production that is not attained with respect to a normal situation, i.e, animals, milk, and other products. This is difficult to estimate and will depend on the season of the year, the categories of cattle bought to replace the slaughtered ones, etc. The downtime period could be short or could extend greatly beyond the repopulation time depending on the decisions made by the producer, because the producer can repopulate with a different category and affect future production. For example, the farmer could chose to buy heifer calves to replace the slaughtered cows. This decision greatly affects the cash flow because he/she will not have calves to sell at least for 2 years.
- Disinfection costs. All animal housing, indoor and outdoor pens, yards, water troughs, feed bunks, etc need to be cleaned and disinfected. This will involve labor, use of water, chemicals and possibly personal protective gear.

There are some additional costs that could be expected in the case of government involvement such as:

- Farm inspections
- Inability to sell other farm products (such as corn, wheat, vegetables) because of movement restrictions in the infected area

There are some costs that can be saved during this time such as:

- Money spent on salaries if employees are not retained during the quarantine period
- Manager (owner) opportunity cost if the he/she can get a job somewhere else during this time
- Part of the feed costs
- Veterinary and health related costs
- Other variable costs

The cash flow during the clean up phase will be negative as there is no revenue and there are expenses. The length of this phase will be determined in part by the disease and will impact the lost revenue. The amount of expenses depends largely on how the farmer handles labor during the down time.

Repopulation

During this period, cattle are bought to repopulate the farm. This is typically a gradual process and may involve bringing a few (sentinel) animals to the farm first and they are inspected and monitored for signs of illness. The rest of the cattle are bought after a period of time.

Costs are similar for both government mandated and voluntary depopulation situations:

- Cost of testing sentinel cattle before bringing them to the farm
- Cost of buying sentinel cattle and transporting them to the farm
- Farm inspections/monitoring for illness
- Tests performed on sentinel cattle
- Cost of buying additional cattle to repopulate the farm
- Cost of transporting the purchased cattle to the farm
- Vaccination and deworming of incoming cattle

The revenue from selling cattle is affected by the initial inventory and the time of the year when the outbreak occurs. The producer's purchasing decisions at repopulation not only affect the costs of buying cattle at repopulation but it can also affect successive years' inventory and production. Therefore the simplest way of estimating the effect of the depopulation/repopulation practice is by comparing the livestock existences, production and movements to a baseline situation with an outbreak situation for an extended period of 3 years after the outbreak. Three years is chosen to capture the impact on herds that only repopulate with young stock rather than breeding cattle. In this case there is a period of time without cattle sales. This comparison to the baseline can be done by following the procedure on the *Cattle* sheet of each *Depopulation Repopulation* file.

The result of this sheet is:
$TLRC= (FI_1-II_1+R_1-C_1)-(FI_2-II_2+R_2-C_2)$ where:

TLRC is the total livestock related cost
FI_1 is the value of the final cattle inventory for the baseline case
II_1 is the value of the initial cattle inventory for the baseline case
R_1 are the expected revenues for the baseline case
C_1 are the expected costs for the baseline case
FI_2 is the value of the final cattle inventory for the depopulation-repopulation case
II_2 is the value of the initial cattle inventory for the depopulation-repopulation case
R_2 are the expected revenues for the depopulation-repopulation case
C_2 are the expected costs for the depopulation-repopulation case

The set of spreadsheets has 3 files that help to estimate depopulation repopulation costs:
• *Depopulation Repopulation Cow calf* for cow-calf operations
• *Depopulation Repopulation Feedlot* for feedlot operations
• *Depopulation Repopulation Dairy* for dairy operations

The *Depopulation Repopulation Dairy* file

The *Depopulation Repopulation Dairy* file has 6 sheets:

- *Cattle*. This helps to estimate the cash flows from selling and buying livestock, the value of cattle production (other than milk) and the value of cattle inventory at the beginning and end of the year (for 3 consecutive years) for the depop-repop situation and for the baseline situation without the disease outbreak.
- *MilkValue*. This helps to estimate the value of the change in milk production in the depop-repop situation with respect to the baseline situation for 3 consecutive years.
- *Period1, Period2, and Period3*. These help to estimate the costs and the money saved in each of the 3 periods
- *Total Cost*. This summarizes the results of the 5 sheets described above showing the difference in cash flows on the 3 periods between the baseline and outbreak situations. It also shows the long term effect of this practice on cattle production.

***Cattle* sheet:**

This sheet helps estimate the cash flows coming from cattle sold and purchased and cattle production for a three year period. It compares a baseline cash flow from cattle with the situation where the farm is depopulated and repopulated in the same calendar year. It could happen that the two events occur in different calendar years; in this case there will be some tax implications that should be analyzed by the producer.

The producer needs to input calving rate, cull rate, and cow, heifer and calf mortality rate information. He/she will need to input number of head, weight and prices for the different cattle categories in stock and information about cattle sold and bought at depopulation and repopulation times. Basically he/she needs to complete all the blue underlined values with his/her own numbers. The program estimates the other values automatically.

The size of the table is rather large and does not fit in this page, but it can be accessed in the *Depopulation Repopulation Dairy* file.

The results from this table supplies information to *Period1, Period2, and Period3* sheets.

***MilkValue* sheet:**

It is possible that the total quantity and/or quality of milk produced after repopulation differs from the baseline situation depending on the category and genetics of the cattle purchased. This sheet helps to estimate the value of the change in milk production in the depop-repop situation with respect to the baseline situation for 3 consecutive years. The producer must evaluate if his/her purchasing decisions at repopulation affect milk production in the subsequent years and input the expected milk production and price in this sheet under both scenarios. This example demonstrates the situation where the producer purchases better cattle and therefore achieves a higher production and/or price in the subsequent years.

Value of change in milk production in the subsequent years							
	Depopulation-Repopulation situation			Baseline situation			Value of change in milk production ($)
	Total milk production (lbs)	Milk price ($/lb)	Value	Total milk production (lbs)	Milk price ($/lb)	Value	
Year 1 after repopulation	900000	0.140	126000	900000	0.140	126000	**0**
Year 2 after repopulation	3800000	0.141	535800	3600000	0.140	504000	**31800**
Year 3 after repopulation	3800000	0.141	535800	3600000	0.140	504000	**31800**

***Period1* sheet:**

The sheet starts with a summary of the livestock inventory at depopulation time. The producer needs to input information about number of head and average weight for each cattle category on the farm, and the spreadsheet automatically estimates the total number of head and weight of the livestock inventory on the farm when the outbreak occurs.

Suppose this is the cattle inventory when the outbreak occurs			
	Number of head	Weight (lbs)	Total lbs
Cows	198	1040	205920
Heifers	67	800	53600
Calves	92	300	27600
Feeder cows	65	1200	78000
TOTAL	**422**		**365120**

Below the livestock inventory table is a list of possible costs to be estimated. The producer needs to complete all the blue underlined values if they apply. The list intends to be exhaustive but it is possible that other costs that were not taken into account could arise for a particular situation. Therefore the producer needs to analyze his particular case and see if there are other costs involved or if there are some of these costs that do not apply for their situation (if so, just enter zeros). At the bottom of the page are the total costs for the depopulation period and the income from selling the cattle (to the slaughter plant or to the government).

Cost of slaughtering one animal	2
Number of head in existence	422
Cost of slaughtering the cattle	**844**
Cost of disposing carcass ($/lb)	0.07
Total lbs of cattle on the farm	365120
Cost of disposing the cattle	**25558**
Cost of disposing feedstuffs ($/lb)	0.01
Feedstuff value ($/lb)	0.05
Lbs of feedstuffs to dispose	160000
Cost of disposing feedstuffs	**9600**
Cost of disposing bedding ($/lb)	0.01
Bedding value ($/lb)	0.001
Lbs of bedding to dispose	6000
Cost of disposing bedding	**66**
Cost of disposing manure ($/lb)	0.01
Manure value ($/lb)	0
Lbs of manure to dispose	50000
Cost of disposing manure	**500**
Cost of disposing other contaminated material ($/lb)	0.01
Other contaminated material value ($/lb)	0.03
Lbs of other contaminated material to dispose	1000
Cost of disposing other contaminated material	**40**
Transportation of cattle to slaughter facility	0
Commissions and marketing fees	0
Total cost of Depopulation period	**36608**
Additional income from selling all the cattle at Depop	**529650**

***Period2* sheet:**

This sheet has two lists of variables to be estimated. The first one is the list of the potential **costs** during the quarantine period. It considers costs of farm inspections, disinfection costs and costs associated with the inability to sell other farm products because of movement restrictions in the infected area. It adds up all of the potential costs at the bottom of the list.

Potential costs	
Farm inspections cost	**100**
Other farm products price at beginning of quarantine ($/lb)	0.05
Other farm products price at end of quarantine ($/lb)	0.05
Cost of carrying other farm products on the farm ($/lb)	0.001
Lbs of Other farm products	1000
Inability to commercialize other farm products	**1**
Disinfection costs	**400**
Average milk production (lbs/day)	9900
Days the farm is not operating	60
Milk price ($/lbs)	0.14
Opportunity cost of milk NOT produced	**83160**
Total costs of quarantine period	**83661**

The second one is the list of the potential **savings** during the quarantine period. It considers the savings from feed (that is not consumed during the period), veterinary and health expenses, salaries and the opportunity cost of the owners' time as he/she gets a job somewhere else for this period. It adds up all of the potential benefits at the bottom of the list.

Potential savings	
Salaries saved by not retaining employees	**20000**
Money usually withdrawn by the owner ($/day)	250
Days the farm is not operating	60
Will the owner get a job somewhere else? Yes=1, No=0	1
Owner opportunity cost	**15000**
Feed cost saved	**39000**
Veterinary and health costs saved	**3000**
Fuel and utilities saved	**4900**
Other costs saved	**0**
Total savings on quarantine period	**81900**

At the bottom of the page are the net costs for the quarantine period before considering the loss in production, the cost of not receiving income from selling cattle in a normal year and the costs saved from not buying cattle that are normally purchased (the last 2 values are completed by data in the *Cattle* sheet).

Net costs of Quarantine period	**1770**
Income not received from selling cattle in a normal year	**107500**
Costs saved from not buying cattle in a normal year	**0**

***Period3* sheet:**

This sheet is similar to the other two sheets (above) and helps to estimate the costs at repopulation time. These costs include:

- Farm inspections
- Testing sentinel cattle for key diseases – they are typically tested twice (once at arrival and again after few days/weeks on the farm)
- Testing the rest of the incoming cattle for key diseases
- Vaccinating and deworming incoming cattle
- Transportation to the farm of incoming cattle and marketing fees and commissions if they apply

Farm inspections cost	**100**
Tests performed on sentinel cattle	
Number of head of sentinel cattle	67
Tests per head in the period	2
Cost per test	2
Total	**268**
Testing incoming cattle	
Number of head of cattle brought to the farm	266
Cost of testing each animal	2
Total	**532**
Commissions and marketing fees	**3800**
Transportation of cattle to the farm	**2700**
Vaccinating incoming cattle	
Number of head of cattle brought to the farm	266
Cost of vaccinating each animal	1
Total	**266**
Deworming incoming cattle	
Number of head of cattle brought to the farm	266
Cost of de-worming each animal	0.5
Total	**133**

At the bottom of the page are the net costs for the repopulation period before considering the cost of buying cattle. The costs of buying cattle to repopulate and changes in final inventory are shown below.

Total cost of Repopulation period	**7799**
Additional cost from buying cattle to repopulate	**444600**
Difference in the value of the final inventory between the baseline and depop	**0**

***Total Cost* sheet:**

The first table (shown below, left) of this sheet summarizes the difference in cash flows of the 3 periods between the baseline and outbreak situations and shows the total cost of the depopulation-repopulation practice for the first year. The difference in cash flow for the 1st period (depopulation period) is positive and large because all the cattle in existence are sold at this time. But this positive difference in cash flow is followed by 2 negative cash flows in periods 2 (quarantine period) and 3 (repopulation period) with respect to the baseline situation. Depopulating (period 1) causes the producer to not have milk and calves to sell in the second period which drives the negative difference in cash flow during the quarantine. In the 3rd period the producer needs to repopulate the farm and this is the cost that drives the negative difference in cash flow in the repopulation period. For the example listed below, the overall difference in cash flow is nearly negative $68,500.

The second table (shown below, right) shows the expected change in production in the first year after repopulation (from repopulation to the end of the year) and on years 2 and 3 after depopulation. It is intended to show the long term effect on production of repopulating with cattle different than the ones on farm at depopulation time. These numbers are the addition of the change in production of livestock (from *Cattle* sheet) and milk (from *MilkValue* sheet). In this specific example there was no change in production in the first year but an increase in production subsequent years because of purchasing better quality cattle. Some of the producer's decisions at repopulation time will also affect the cost of production and he/she needs to analyze these as well. This article does not address this part because the authors understand that there are many decisions that can be made and it is nearly impossible to cover all of them.

Period 1 net costs difference	493042		Change in Production w.r.t baseline	
Period 2 net costs difference	-109270		1st year after depopulation	0
Period 3 net costs difference	-452399		2nd year after depopulation	31800
Total costs	**-68627**		3rd year after depopulation	31800