



Government Report Hashemite Kingdom of Jordan Rainfall Enhancement Project 3 Year Results 2016-2019

تقرير حكومة
المملكة الاردنية الهاشمية

مشروع تعزيز هطول الأمطار
نتائج 3 سنوات 2016-2019



Ministry of Water and Irrigation

وزارة المياه والري



Jordanian
Farmers
Association
الاتحاد العام
للمزارعين الاردنيين



Jordan
Meteorological
Department
دائرة الارصاد
الجوية



Ministry of Transport

وزارة النقل

Amman, July 2019

عمان، يوليو 2019



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For any additional information please contact:

Hatem Al-Halabi
Director of Quality & institutional development
Jordan Meteorological Department
Hatem_met@hotmail.com

للمزيد من اي معلومات الرجاء التواصل مع:

حاتم الحلبي
مدير الجودة والتطوير المؤسسي
دائرة الأرصاد الجوية الأردنية
Hatem_met@hotmail.com



Executive Summary

Government Report of the Hashemite Kingdom of Jordan Rainfall Enhancement Project: 3 Year Results 2016-2019

1. Report of the Jordan Meteorological Department, Ministry of Transport

- 27% increase of rainfall in the influenced area compared with the 30-year average over the three years.
- 35% is the real increase of the additional rainfall: 27% and including the decrease of 8% in the neighboring areas = 35%.
- 47% was the highest percentage increase during a season in a major region.
- The rainy season extended from the beginning of fall until the end of spring.
- Volumes of rainfalls with Hundreds of Millions of m³. More days with rainfalls per season.

2. Report of the Ministry for Water and Irrigation

- WeatherTec can play an important role in mitigating the impact of climate change in Jordan.
- Breaking and reversing term 30-years trend of constant decline of precipitation and increase of drought in the influenced area, with big difference to the neighboring areas, where the trend continued.
- Dams were filled for the first time in 40 years, with an overspill increasing irrigation in the Jordan valley; only 2018/19 from 40% to 57% dam storage nationwide.
- Catchment areas received more freshwater, Zarqa river (national biggest) increased multi-fold.
- Reduction potential for decline of groundwater, already restoration of springs, which were dry for decades
- Increase in the number of rainy days and duration of rain seasons, big saving in irrigation
- Analysis with Drought Indicator CDI and Precipitation Indicator PDI according WMO measuring successfully the impact of WeatherTec regarding precipitation, temperature, vegetation factors.

3. Report of Jordanian Farmers Union

- 30% increase in the production of rainfed plants that relies on rainfall as the primary and only source of irrigation, including olive trees, which are most important for the Kingdom.
- Strong increase in the green vegetation cover, specifically the field crops (wheat and barley), as well as, herbs and pastoral shrubs. Simultaneously strong increase in fruit production and export opportunity.
- Increase of biodiversity
- Groundwater level raised substantially, dwells were reactivated
- Re-emergence of beneficial medicinal plants, that were almost extinct in the last years.
- Decrease in the incidence of pests and diseases, due to the increased rainfall and lower temperature
- Reduction in the (import) costs of production for the farmers regarding dried animal fodder.
- Reduction in the cost of preventive and curative medicines given to animals.
- Increase in quantities and quality of animal milk and its products.
- Increase of domestic livestock: the number of imported livestock dropped from 1 million head before to 300,000 head (-70% import), substantially growing national self-supply.



Background Information

The Company WeatherTec, its Rainfall Enhancement Technology and its Project and Operations in the Hashemite Kingdom of Jordan

More information can be found on the Company's Website: www.weathertec-services.com

The Company

WeatherTec AG is a German-Swiss hightech environmental company, which has been applying its invented technology since 2004 on three continents, working only for governments.

- Swiss-German managers, international experts in meteorology, climatology, atmospheric, space science
- Heads of Advisory Board and Impact Board: Prof. Peter Wilderer, Prof. Jörg Imberger, both Stockholm Water Prize Laureate (so-called "Water Noble Prize"); Prof Mangstl, Director FAO; Ray Garcia, US entrepreneur
- Winner of Laudato Si Challenge Prize 2018, Vatican as the worldwide best solution to fight forced migration, the World's biggest source for additional freshwater with the potential to bring water security, consequently food security to a billion people;
- Presented 2019 on the World Economic Forum, Davos as "next generation" freshwater source.

The Rainfall Enhancement Technology

The WeatherTec technology is a rainfall enhancement technology, enabling to add big volumes of rainwater through Ionization of the air influencing the growth of raindrops in clouds above. It is mimicking the natural processes by ground-based systems:

- Environmentally friendly, solar powered, ("Sun makes Rain!") Zero CO2, Big Data, Digital 4.0
- Command and Control Centers, own forecast model, rain radar, drones, data center,
- Cooperation and due diligence with experts from Max Planck Institute, TUM Munich, Queensland University, ETH Zurich; certification for ISO 2008 by TÜV SÜD, Germany

Operations in the Hashemite Kingdom of Jordan

Operation Site, Madaba



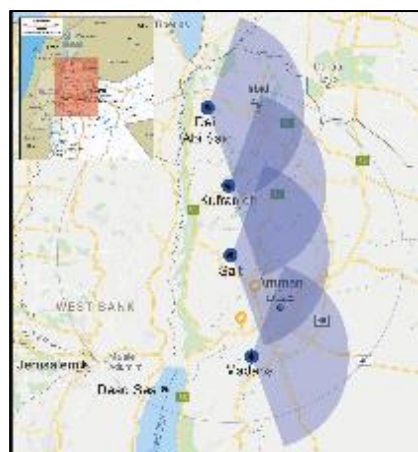
Command and Control Center, Amman



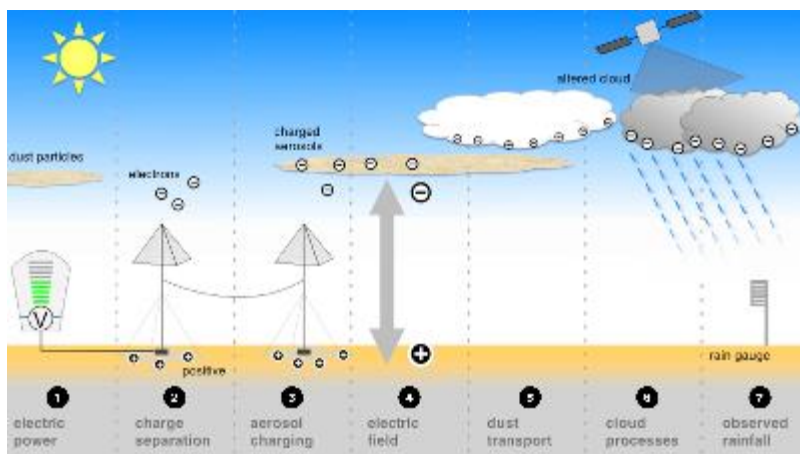


Project Area: Emitter Sites Locations and Influenced Area, Technology

Core influenced Operation Area
5.000 km²



WeatherTec's Ionization Technology
Mimicking natural processes to initiate and enhance rainfall



1. High voltage is provided to the emitters on the ground with solar power
2. They emit trillions of ions into the atmosphere that connect to aerosols
3. They create a plume of negative charges, which elevates by natural updrafts & winds
4. The Earth electric field gets slightly influenced
5. Cloud particles such as ice nuclei and droplets become charged near cloud boundaries growing much quicker
6. Enhanced clouds are developed and rainfall occurs over several 1'000 km²

WeatherTec's Rainfall Enhancement Technology compared with other Production Technologies for additional Freshwater

Technology	WeatherTec	Cloud Seeding (Stopped in Jordan in 2019)	Desalination
Process	Ionization of air causes fast growing droplets	Spraying chemicals in clouds by planes	Osmosis process
Impact on Environment	Very big volumes, most environmetally friendly	No measurable impact in additional rainfall, often poisoning chemicals	Energy footprint very high, salination of the Sea
Price / m ³	0,1 € most inexpensive	Very expensive	0,75-3 €
Capital Investment	Service – no investment	20+ Mill €	20-800 Mill €
Running costs	Service € 1,5-2 Mill/month for project area 5.000+ km ²	Flights and Chemicals,	High fossil and solar energy cost



Ministry of Transport
Meteorological Department

Report of the Jordan Meteorological Department

H.E. Director General Hassan Momani

Official Translation of Original Document

Messrs. Al Qudra Environmental Consulting

With reference to your letter no. 3/A.C/2019 dated 13/May/2019, requesting an assesment report for the end of the rainy season, which provides a comparission of the rainy season within the target areas and outside the target areas. In addition to the necessary analyses of the overall trend, which provide a comparison over the previous thirty years, enclosed herewith is the requested data.

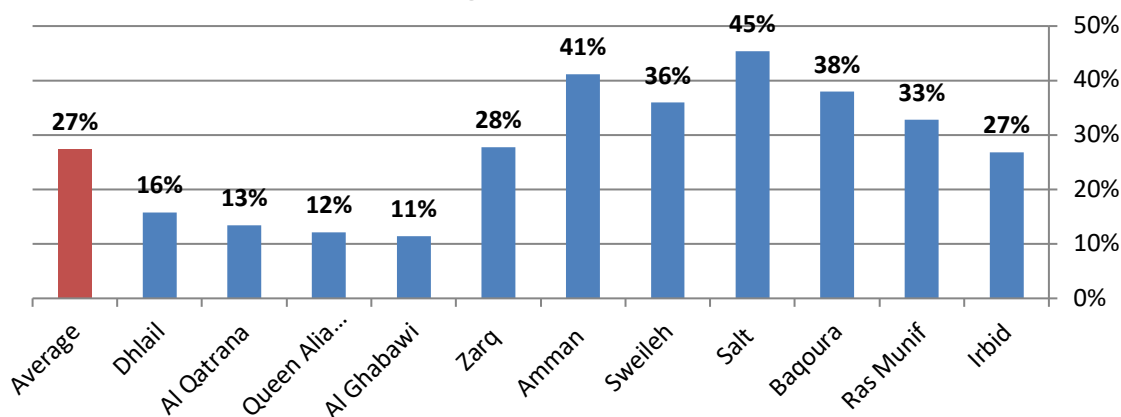
Statistical report for the rainy season 2018/2019 <u>within the target areas</u>					
Percentage of increase/decrease %	Period performance %	Actual cumulative total/mm	Total Cumulative probability/mm	Station	Location
27%	127%	569.8	449.2	Irbid	Within the target areas
33%	133%	779.2	586.8	Ras Munif	
38%	138%	536.8	388.0	Baqoura	
45%	145%	748.5	514.8	Salt	
36%	136%	646.7	475.6	Sweileh	
41%	141%	346.8	245.6	Amman	
28%	128%	159.9	125.2	Zarqa	
11%	111%	97.6	87.6	Al Ghabawi	
12%	112%	168.1	150.0	Queen Alia International Airport	
13%	113%	109.8	96.8	Al Qatrana	
16%	116%	154.5	133.4	Dhlail	
<u>27%</u>	127%	392.5	295.7	<u>Average</u>	

The above table which depicts the rainy season 2018/2019 within the target areas, shows that the minimum percentage increase was (11%), whereas, **the highest percentage increase was (45%), with an average increase of 27% in the overall seasonal average.**



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Statistical report for the rainy season 2018/2019 within the target areas

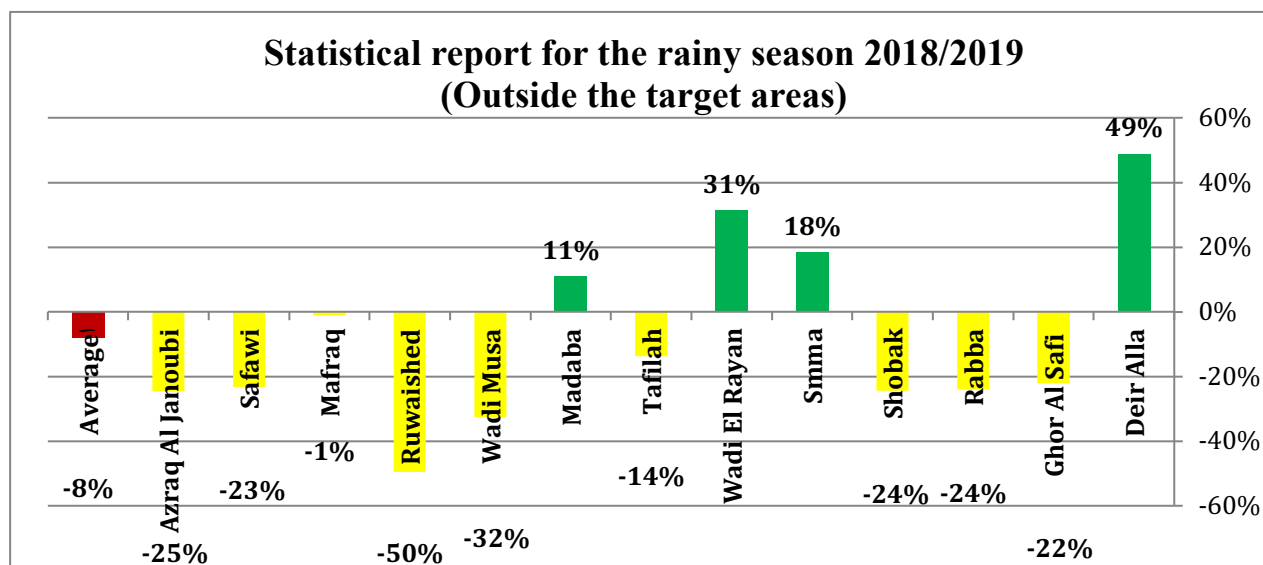


Statistical report for the rainy season 2018/2019 outside the target areas

Percentage of increase/decrease%	Period performance%	Actual cumulative total/mm	Total Cumulative probability/mm	Station	Location
49%	149%	414.6	278.8	Deir Alla	Outside the target areas
-22%	78%	57.0	73.2	Ghor Al Safi	
-24%	76%	249.8	329.0	Rabba	
-24%	76%	186.5	246.6	Shobak	
18%	118%	518.3	438.2	Smma	
31%	131%	407.6	310.1	Wadi El Rayan	
-14%	86%	165.2	191.5	Tafilah	
11%	111%	362.7	326.6	Madaba	
-32%	68%	116.4	172.4	Wadi Musa	
-50%	50%	39.0	77.3	Ruwaished	
-1%	99%	147.3	149.0	Mafrag	
-23%	77%	54.5	71.0	Safawi	
-25%	75%	44.6	59.2	Azraq Al Janoubi	
-8%	92%	212.6	209.5	Average	

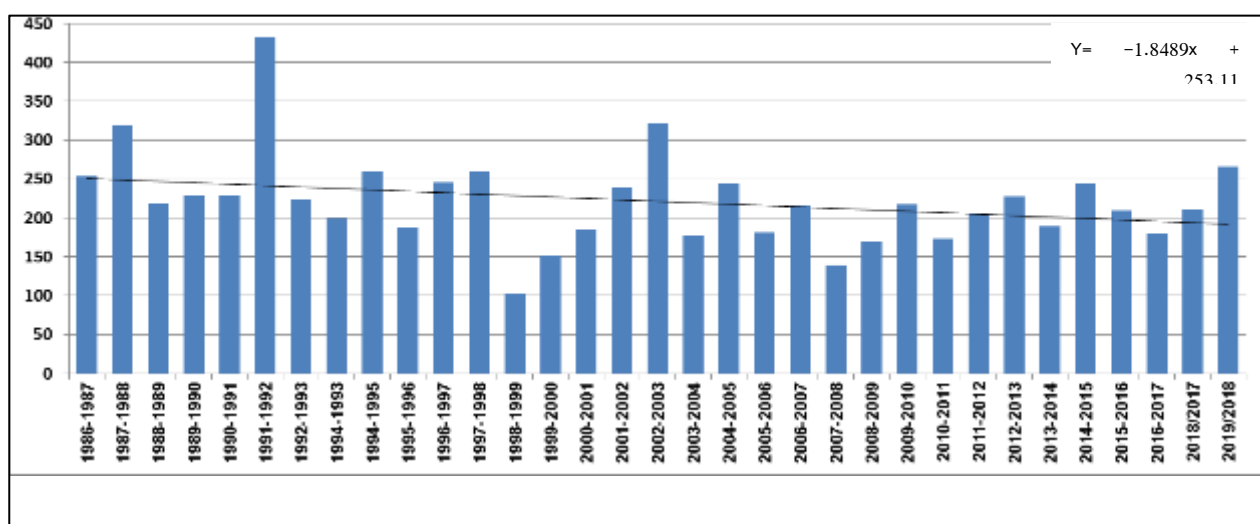


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Considering the percentage increase outside the target areas, which is a decrease of (-8 %) in the overall average, the basis of comparison, the actual increase percentage of the target areas would be as follows: **27 % within the target areas - the actual increase percentage of the target areas - 8 % outside the target areas = 35 % an increase within the target areas in the overall seasonal average.** As regards to the overall average of the rainy seasons in the kingdom, the below model (model no. 1) has been created for the rainy seasons (1986/1987 till 2015/2016). The model indicates that the overall trend of the total rainfall in the kingdom has been decreasing annually by - 2.443 mm in comparison with the overall seasonal average.

**Total seasonal rainfall from 1986/1987 till 2015/2016
Model no. (1)**





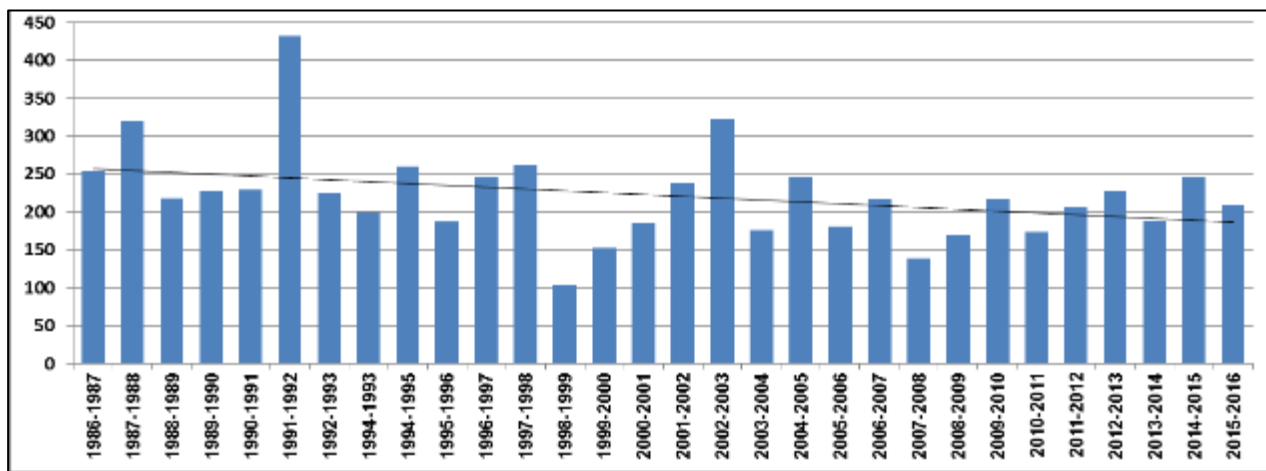
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The graph below (Model no. 2) shows that the overall trend of the average rainfall in the kingdom has been decreasing annually by - 1.8489 mm in comparison with the overall seasonal average for (1986/1987 season till 2018/2019 season)

Total seasonal rainfall from 1986/1987 till 2015/2016

Model no. (2)



We have noticed that there is a decrease in the overall trend of the average rainfall by (0.5941)mm.

signed by

Hussein Al Momani

Director General of the Jordan Meteorological Department
Ministry of Transport



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Report of the Ministry for Water and Irrigation

Three-Year Report on the Implementation of Rain Enhancement by Ionization Technology in the Hashemite Kingdom of Jordan

by
Eng. Ali Subah
Director General
Ministry of Water and Irrigation
of the
Hashemite Kingdom of Jordan

July 2019



Ministry of Water and Irrigation

Ministry of Water and Irrigation

Ref: MWI/1/5/26/1434

Date: 31/07/2019

Executive Summary

1. Findings:

The Ministry of Water and Irrigation (MWI) of Jordan, as a member of the governmental Steering and Technical Committees, had been monitoring operations of the Rainfall Enhancement by Ionization Technology of the Swiss-German Company WeatherTec from 2016 - 2019. During this period, extensive measurements and observations were conducted, as the Hashemite Kingdom of Jordan ranks as one of most water-poorest country and is in search of solutions to prevent constant decline of freshwater availability.

The major findings of the Ministry of Water and Irrigation Report can be summarized as follows:

1. In the past three years, the long-term 30-years trend of constant decline of Combined Drought Indicator (CDI) and Precipitation Drought Index (PDI) indicators were broken and reversed in the influenced area, considering the obvious differentiation to the neighboring areas, where the trend continued with an exponential decrease.
2. Dams were simultaneously filled for the first time in 40 years, with an overspill, the dam's storage increase enabling irrigation capability in the summer months.
3. Could reduce further rapid decline of groundwater, restoration of springs that had been dry for decades.
4. The higher frequency of rain events and the longer duration of rainy season reduced the need for irrigation days that uses water reserve.
5. The analysis of the drought indicators CDI and PDI which uses combined data of precipitation, temperature and vegetation shows that the impact of rain enhancement technology can be used in Jordan as an instrument to stop and reverse declining trend of freshwater availability.

2. Methodology of the Report:

In May 2016, the Hashemite Kingdom of Jordan adopted Ionization Technology provided by WeatherTec Services GmbH, which was existential for the one of most water-poorest country, in order to enhance rainfall and mitigate the future forecasted reduction in rainfall amounts. As a member of the governmental Steering Committee, which observed and evaluated the technology, the MWI assess in this report the impact of this technology in the northern part of the Kingdom over the last three years, until the end of the 2019 rain season.

Areas influenced by WeatherTec operations will be mentioned as "influenced area". Neighboring areas, which are located outside the operation areas will be mentioned as "non-influenced areas". The report has a goal to cover all the rainfall related impacts observed by the Ministry of Water and Irrigation.

The report can be also seen as a part of comprehensive study of the drought situation in Jordan, which was conducted by the Ministry of Water Irrigation after the end of the rain season 2019. The study based on mapping of drought using Numerical Combined Drought Indicator (CDI) and Precipitation Drought Indicator (PDI). The study investigated trends in 25 locations in the Kingdom that showed long-term trends of CDI and PDI decreased everywhere in the country. However, the trends of last five-years increased positively in



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most of stations of the northwestern regions, which represent the influenced area of WeatherTec. This resulted in an increase the flood flow and/or runoff.

3. Impact on Availability of Freshwater

Jordan depends mainly on groundwater to cover the demand for irrigation and domestic use. Currently we have a large deficit in water resources. Therefore our quest for non-conventional sources to cover the deficit can be partially met by this promising technology.

3.1 Dams storage

Most importantly, the influence is reflected on dam's storage conditions in the northwestern regions of the Kingdom. The dam's storage in year 2019 for the whole of the Kingdom rose to 57 %, with a total stored of 192 million cubic meters, compared with 40% in the 2018. This relies on the rainfall increase in the influenced area, while the neighboring areas had a strong decline. Dams were simultaneously filled for the first time in 40 years, with an overspill, the dam's storage increase enabling irrigation capability in the summer months.

- 1- King Talal Dam with a total capacity of 75 million cubic meters,
- 2- Al Mojib Dam with a total capacity of 29.8 million cubic meters,
- 3- Al Wala Dam with a total capacity of 18.8 million cubic meters,
- 4- Wadi Shu'aib Dam with a total capacity of 1.7 million cubic meters.

3.2 Wadies and Ravines

The catchment areas in the influenced area received more freshwater; increasing the base flow that discharges to the dams and to King Abdulla Chanel this can be put to useful irrigation. The Zarqa river, partly fed by the wastewater plant near Zarqa, increased multifold in volume, consequently resulting in higher water quality.

3.3 Groundwater and springs

In numerous locations, The Kingdom suffers under a rapid decline of groundwater level. In some areas the groundwater level declines by 7-10 meters annually. The first measurements are proving a mitigating effect; more research is ongoing. A clear indication that old dried springs in the influenced area rejuvenated and burst for the first time since decades.

4. Special impact of the Rain Enhancement Operations

Increase in the number of rainy days and duration of the rain season

An important observation is the increase in the length of the season through the increase of rainy days. During all the three years of the analysis the numbers of days with rainfall increased. This will have a positive impact on the water availability as more rainfall days enable to mitigate drought situations and create a more constant supply of rain irrigated land and constant run off.



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5. Analysis of Rainfall Enhancement Impacts using Drought Indicators

Water scarcity in Jordan is a known problem that presents a challenge to development plans in different sectors. The problem is exacerbated by droughts resulting from the decreased precipitation and uneven spatial and temporal distributions, high population growth and hosting of refugee waves, increasing economic development needs and the adverse climate change. Over the past two decades, Jordan has witnessed a sharp decline and fluctuation in rainfall, exacerbating pressures on water availability, distribution and affordability by the government and its citizens, as well as giving priority to the use of fresh water for household purposes. Several studies and forecasts have shown that drought severity will increase in the future, with predictions suggesting that drought would occur once every three to four years.

Drought can be defined as the consequence of a period of lower than expected or lower than normal precipitation over an extended period of time leading to a water shortage for some activities, groups, and environmental sectors. Besides low precipitation levels, the occurrence of drought results from evaporation which is affected by temperature, wind, vegetation, type of soil and its capacity to store water, as well as the presence of groundwater supply.

The severity of drought is also affected by increasing pressure on water supply sources due to rising demand for water from irrigation, industry, and domestic use. The literature commonly classifies drought into Meteorological, Agricultural, Hydrological and Socio-economic droughts. While meteorological drought mainly refers to a decrease of precipitation. Other types emphasize the human and social aspects of drought as well as the relation between the characteristics of meteorological drought and human activities. The interaction between the different types of droughts may also result in an environmental drought that carries severe impacts on affected ecosystems.

5.1 Drought Indicators CDI and PDI

Monitoring and assessment of drought severity, vulnerability and hazards require the use of a suitable indicator that reflects the conditions of drought at different spatial and temporal scales. A wide range of indicators (variables or parameters) and indices (computed numerical representations) may be used for these purposes. All of these are summarized by the handbook recently published by WMO (WMO and GWP, 2016). Selection of indicator or index mainly depend on data availability as well as the type of drought being monitored.

Numerical Combined Drought Indicator (CDI)

Numerical CDI was proposed for drought monitoring. The CDI has shown a strong correlation between rainfed production yield and reflected drought levels in Jordan. The software needed for the calculating of the CDI was developed by FAO SWALIM, while climatic data of Jordan Meteorological Department (JMD) will be used for this purpose. The numerical CDI includes: Precipitation Drought Index (PDI); Temperature Drought Index (TDI), Vegetation Drought Index (VDI) as a substitute to soil moisture. The CDI is computed as a combination of the PDI, TDI and VDI with weight (w) for each component. The total weights are summed to one. All the indices that are computed by the software are in defined time periods, either in decadal (10 days) or monthly.

The equation of CDI is:

$$CDI_{i,m} = w_{PDI} * PDI_{i,m} + w_{TDI} * TDI_{i,m} + w_{VDI} * VDI_{i,m}$$

Where w is the weight of the individual drought index.



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The weights can be chosen according to various application environments, geographic locations and climate conditions. As a starting set of values, it is recommended to use 50% weight for PDI and 25-25% weight for TDI and VDI.

Results

Data of 25 weather stations distributed across the Kingdom was used in this study to map the country's drought. The data was collected by the JMD, MWI and other authorities. To obtain the seasonal drought index, the used software (CDI computation software developed by FAO-SWALIM) was running to calculate the seasonal CDI and PDI every 6 months (Nov - April) for all stations; the index for April was selected to be the end of season. We consider here the season 2018/2019 in which WeatherTec's operations covered the whole period. Figure 2 shows the seasonal CDI (left) and Seasonal PDI (right) maps of 2019. The figure shows that the season was a good precipitation season, especially in the northwestern regions. The blue color refers to "above normal" areas, while regions in northern and central parts show "no drought" (dark green) and have a better season than the south and east regions of the Kingdom. The PDI chart shows that precipitation in the northwestern and central regions was especially high, where the eastern and some southwestern regions received the lowest precipitation amount.



Figure 1: Map of Jordan includes stations used in the study

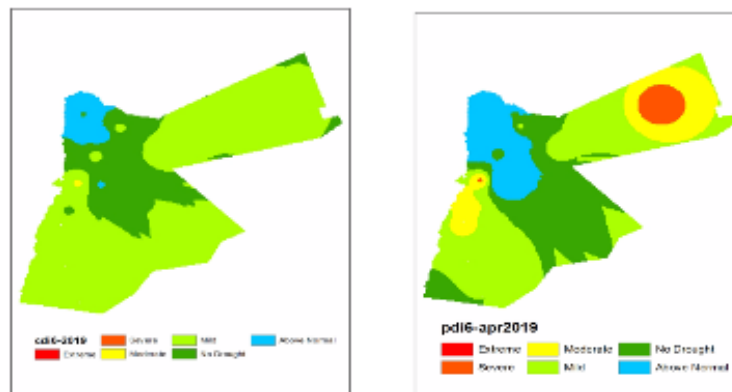


Figure 2: Seasonal CDI (left) and PDI (right) maps of 2019, the season resulted in a good precipitation season. The northwestern regions are above normal (blue color), regions in northern and central parts show no drought (dark green) and they have better season than the south and east regions of the Kingdom.

5.2 Calculation of Drought Trends

In order to investigate the impact of WeatherTec operations on the drought conditions, the CDI and PDI trends in the last five years in comparison to the long-term trends (1985/86 – 2018/19) have been studied. The data of four stations located inside the operation area (Irbid, Ras Muneif, Salt, and Amman) have been selected to represent the area affected by WeatherTec operations.



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We will refer to those stations as affected stations. On the other hand, data of four neighboring stations, two to the east (Azraq and Safawi) and two to the south (Er-Rabba and Shoubak) of the operation areas, have been selected to represent the non-influenced areas. We will refer to those stations as non-affected stations. The selection of the non-affected stations based on that:

- These stations located close to the influence area and have nearly similar climate and geographic conditions as the operation area,
- The data of these station are fully available.

Figure 3 shows the seasonal CDI and PDI for the affected stations in long-term (1985/86 – 2018/19) data records with linear trend lines. The trends decline in all stations. This is depicted throughout most climate models in Jordan which predicted more drought for Jordan and a further

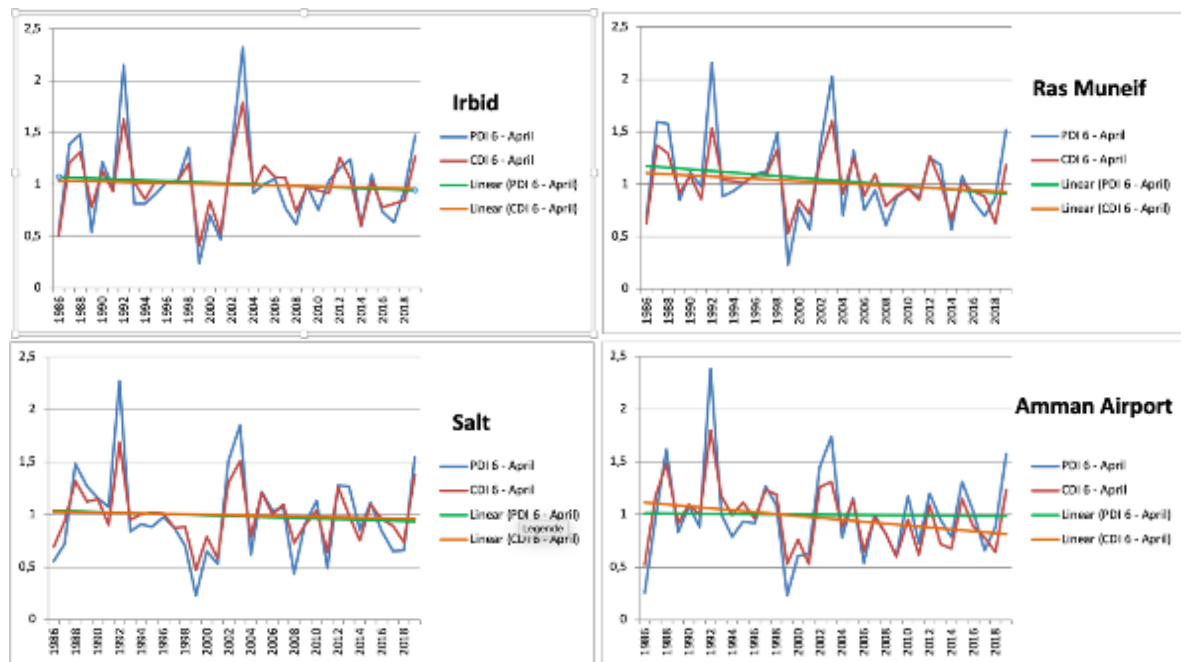


Figure 3: Seasonal CDI and PDI in selected affected stations in northwestern parts of Jordan for the period 1985/86 – 2018/19 (MoWI, 2019). The long-term trends show a decline in all stations.



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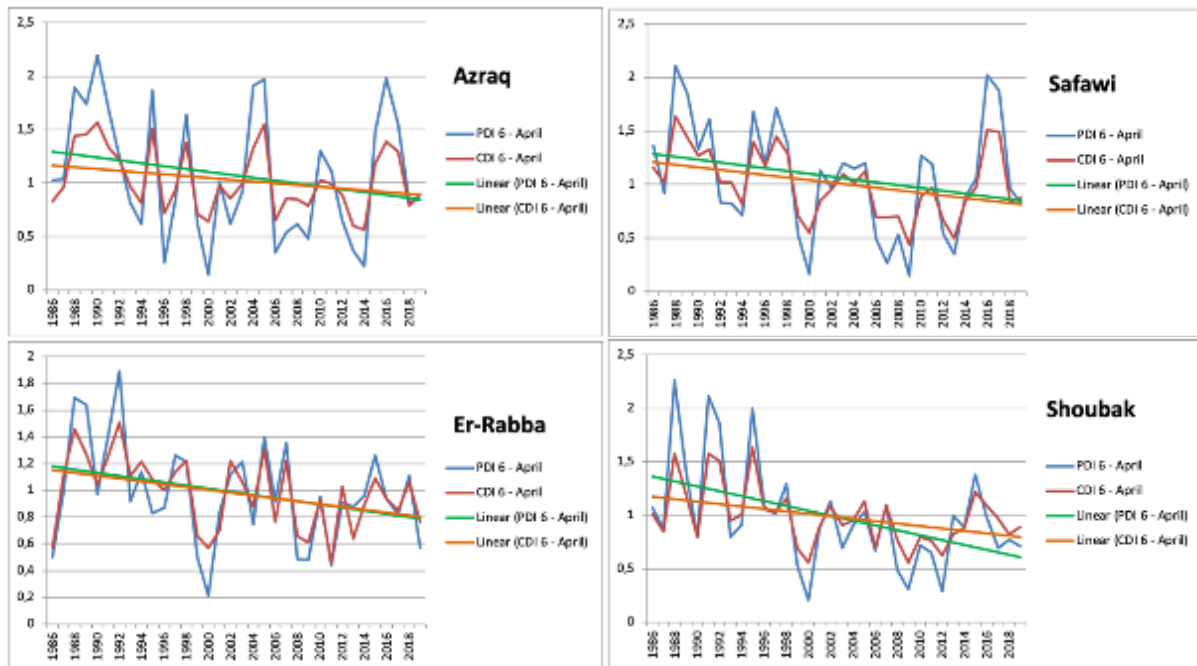


Figure 4: Seasonal CDI and PDI in selected non-affected stations for the period 1985/86 – 2018/19 (MoWI, 2019). The long-term trends show a decline in all stations.

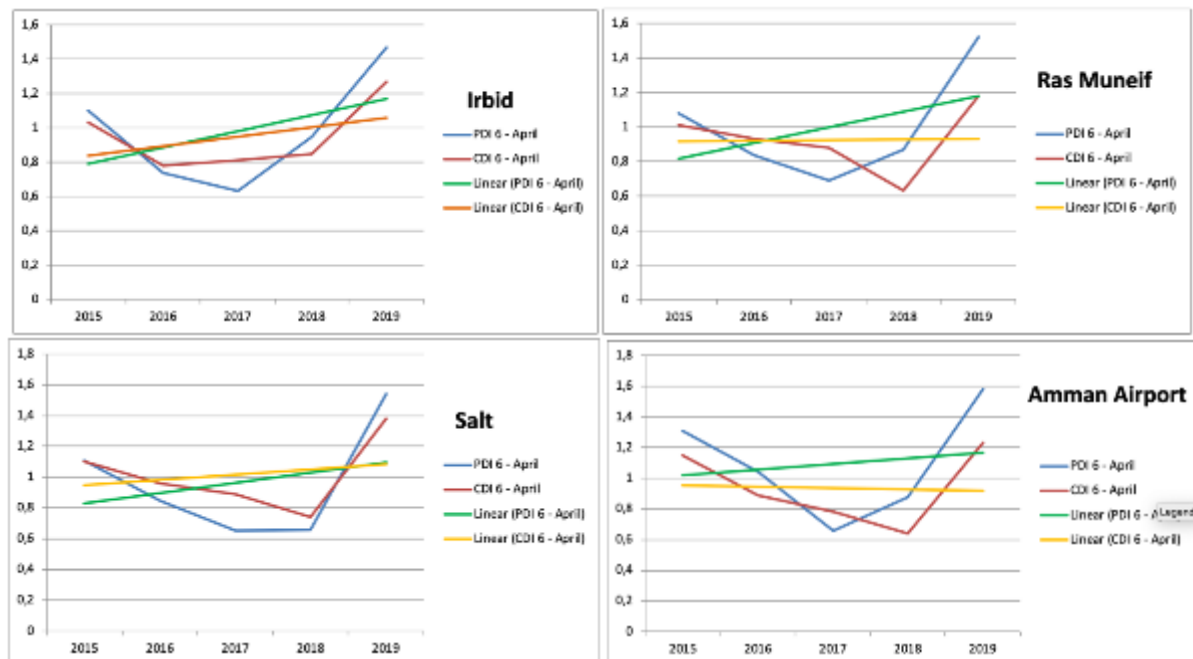


Figure 5: 5-years values of CDI and PDI in the affected station in northwestern area of Jordan (Irbid, Ras Muneef, Salt and Amman) for the period 2014/15 – 2018/19 (MoWI, 2019). The 5-years trends show an increase in the four stations.



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Figure 5 shows the 5-years CDI and PDI trends in the affected stations. Despite the trend in long-term decline, the 5-years trends increase in all stations inside WeatherTec operation areas. This trend increase returns to the significant increase of CDI and PDI in the last three years as shown in the graphics. On the contrary, the 5-years trends of the non-affected stations (Figure 6) show further decline, so they agree with the long-term trends.

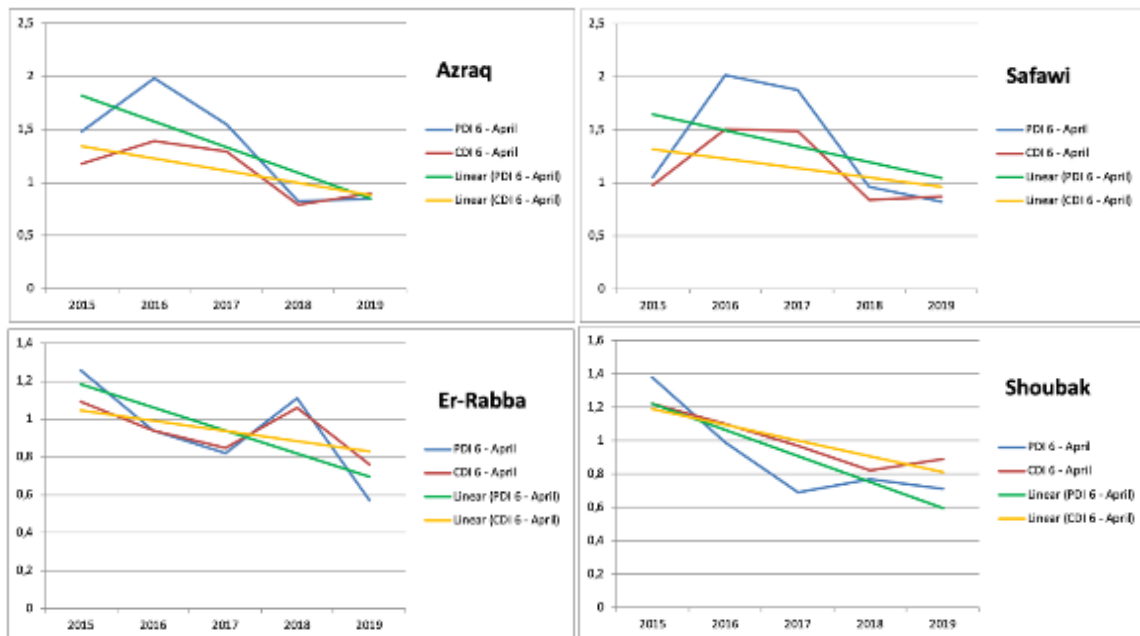


Figure 6: 5-years values of CDI and PDI in the selected non-influenced stations in northeastern (Azraq & Safawi) and southern (Er-Rabba & Shoubak) areas of Jordan for the period 2014/15 – 2018/19 (MoWI, 2019). The 5-years trends show a decline in the four stations.

6. Conclusion

The Ministry of Water and Irrigation (MWI) of Jordan, as a member of the governmental Steering and Technical Committee, has been monitoring operations of the Rainfall Enhancement by Ionization Technology of the Swiss-German Company WeatherTec since 2016.

The following conclusions can be drawn from this CDI and PDI study:

- The 5-years trend of CDI and PDI increased in the influenced area, while it is still decreasing in the non-influenced areas. This means that the operation of WeatherTec stopped the decline in long-term trend.
- Water storage of dams in the whole Kingdom has increased significantly and reached 57% compared to 40% in the past.
- Four dams existing within influenced areas were totally filled by rain water.
- The abundance of rain led to burst out more springs in the central and northern areas, some of them for the first time since decades.
- WeatherTec operations can play an important role in mitigating the impact of climate change in Jordan.



Jordanian Farmers Union

Report of Jordanian Farmers Union

Official Translation of Original Document

H.E Director General Eng. Mahmoud Oran

Ref: 4/U/6/2016

Date: 27/June/2019

In the Light of Changes in the Rainfall Averages

An overall assessment of agricultural reality in the Kingdom of Jordan for the period (2016 – 2018)

The last three seasons (2016-2018) have witnessed changes in rainfall levels, especially in the northern and central regions of the Hashemite Kingdom of Jordan. The changes were exemplified by the increased amounts of rainfall and the increased number of rainy days. The rainy season extended from the beginning of fall until the end of spring, according to the Jordan Meteorological Department's data (JMD). The changes in the amount and distribution of rainfalls had positive effects on all vital sectors that cannot be disregarded, particularly the agriculture and livestock sectors in the Kingdom. It augurs well for a beginning of sustainable development, if the upcoming rainy seasons remains as the abovementioned seasons.

This report is based on the statistics and data available at different official authorities. In addition to the species and field observations, certifications and reports of farmers and specialists, most notably:

- Increase in the green vegetation cover, specifically the field crops (wheat and barley), *as well as*, herbs and pastoral shrubs.
- Re-emergence of beneficial medicinal plants, that were almost extinct in the last years.
- Increase of 30% in the production of rainfed plants that relies on rainfall as the primary and only source of irrigation, including olive trees, which are considered one of the most important agricultural products for the kingdom.
- Decrease in the incidence of pests and diseases, due to the increased rainfall and lower temperature
- Qualitative and quantitative growth of livestock as a result of the increase in vegetation cover and wild medicinal herbs, which led to an improvement in the health of grazing animals and an increase in the fertility rate of livestock, and consequently an increasing the number of births.
- Reduction in the costs of production for the farmers regarding dried animal fodder.
- Reduction in the cost of preventive and curative medicines given to animals.
- Increase in the quantities and quality of animal milk and its products.
- Decrease in the number of imported livestock to the domestic market from 1 million head before to 300,000 head, by a percentage of 70%.



Jordanian Farmers Union

Following is a review of the most important effects that have taken place in various vital sectors as a result of the increased rainfall:

1- Irrigation and Exkavation:

- An increase in the water flow that runs to the Dead Sea, due to dam flooding and increased water level in King Abdullah Canal.
- Increase in the water lever in excavations, specifically in the eastern regions compared to the previous years, which contributed to the reliance on these excavations for livestock water supply in summer. This has encouraged farmers to increase the investment in animal husbandry sector.
- Water bursts out of some springs which has dried up over the past years, particularly in the northern and central parts of the Kingdom.

2- Agricultural sector:

The increase in rainfall had a direct impact on the agricultural sector in the Kingdom. Following are the most important outcomes of this impact:

- Olive trees:

Despite the alterations in olive fruit production, the observer finds that the quantities of olives received in the domestic market has increased significantly, whether the olive was used for pickling or making olive oil after the pressing process. The figures show a rapid increase in production compared to previous years.

- Field crops:

The Department of Statistics figures indicate that the northern and central governorates have witnessed a significant increase in the field crop production compared to other governorates, due to the increase in soil fertility caused by rain.

Following are the positive effects associated with it:

- Farmers invest more in these crops.
- Import of these crops, particularly barley is decreased.
- Hay production from these crops, used as animal fodder, leads to a reduction of imports associated with this type of fodder.
- The increase of rainfall at the beginning of season has led to an increase in the soil moisture content, which facilitates the processes of tilling and sowing agricultural lands and allows to start it earlier. Thus, bettering the agricultural season.

- Fruitful trees:

Over the last three years there has been a marked increase in the quality and quantity of fruit tree production, due to the abundance of rainfall in agricultural areas, which led to the ease of beneficial



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use of fertilizers, whether organic or chemical, on the one hand, and provides plants a cool atmosphere for a sufficient time, which is essential for the flowering and fruiting processes on the other hand.

The results indicate that the northwestern areas of the Kingdom are the most productive areas. Furthermore, Irbid governorate ranked first among the agricultural regions planted with fruit trees until 2017, followed by the Mafrqa governorate and then Jerash and Zarqa governorates.

- **Pastoral plants:**

The eastern, northern, northeastern and northwestern regions of the Kingdom have witnessed a qualitative increase in the growth of pastoral plants, shrubs and grasses due to the fertility of the season and the increased rain which consequently led to an increase in the soil moisture content.

This has been reflected positively as follows:

- The recovery of animal husbandry sector that feeds on these herbs and consequently the livestock wealth in the Kingdom.
- The reduction of the dry fodder bill such as barely and other feedstuffs.
- The provision of more herbs and medicinal plants that contain essential elements for livestock growth including vitamins and some salts that were not found in processed and dry fodders, which was reflected favorably on the health and preparation of livestock, as it is shown in table no.1 and table no.2.
- The re-emergence of some medicinal plants and pastoral shrubs that were rarely found in the past due to the low rainfall rates and disappearance of some winter circumstances.
- The increase of the instability in the past three years, heavy rainfall, and the emergence of lightning and thunder have caused an increase in the production of some plants that are associated with this weather such as some types of fungi (truffles and all types of mushrooms).

3- Animal resources

Animal resources had its share of the changes in rainfall that prevailed in the past three years, leading to an increase in the rainfall and resulting in vegetation cover, growth of herbs and medicinal plants in pastoralist areas and a decrease in the incidence of diseases that were noted in the past, in particular to the goats' mothers, sheep, and baby animals that did not reach the age of weaning or that stay in the herd grazing with their mothers in pastures.

There was also a decrease in the phenomenon of wool ingestion by livestock that ingest each other's wool to compensate the lack of some mineral salts, which ultimately leads to its death due to two reasons: experts and researchers find that the reason behind the decrease is the reliance on green fodder and pastoral plants which are originally medicinal and aromatic plants utilized for livestock healthcare. These plants support the immune system in livestock. **(See table no. 1)**

Table (1): Preparation of animals vaccinated against infectious and epidemic diseases (Animal Health and Epidemiological Survey)

Animal type	Preparation of animals vaccinated against infectious and epidemic diseases						
	2018	2017	2016	2015	2014	2013	2012
Sheeps	7760257	8150868	7339095	5511871	5665397	5029452	5836733



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Goats	1883659	1972797	1830219	1396149	1569168	1468257	1679207
Cows	157145	151019	118053	113726	113286	107679	76854
Camels	2942	1007	7508	799	863	1859	1822
Horses	1122	832	976	461	693	612	664
Dogs and Cats	76	62	269	173	1498	2493	4091
Total	98399156	10140585	9296390	7023179	7350905	6610452	7599371

The table shows that sheep production in the past three years has increased by 47% compared to the preceding years. Also, the results show that the number of sheeps in the Kingdom has reached 7.7 million head compared to 5.4 million during the previous years. It is significant to note that Mafrq governorate has the largest number of livestock, followed by the capital governorate.

4- Biodiversity

The figures issued at the Directorate of Veterinary in the Kingdom in the last three years demonstrate the emergence and reproduction of some insect species, such as butterflies and snakes. Experts attributes the spread of these insects and reptiles to the growth in vegetation cover, especially in the northern and central regions of the Kingdom. The growth and reproduction of grasses and shrubs contributes to the creation of a fertile environment for laying and hatching eggs and consequently balancing the biodiversity. (table no. 2)

Table (2): Percentage of vaccination in sheep and goats, cattle against infectious and epidemic diseases, 2018

	Sheeps	Goats	Cows	Camels
Livestock census in 2018	3496741	1026836	60646	10872
Fever	41.54%	27.33%	146.48%	0%
Small Ruminant Plague	60.42%	36.49%	0%	0%
Chickenpox	35.93%	27.30%	2.89%	0%
Coal Fever (Anthrax)	4.31%	7.73%	6.19%	4.60%
Maltese fever (Brucella)	16.42%	13.42%	0%	0%
Intestinal poisoning	62.11%	70.10%	103.18%	7.64%

The above table shows an increase in the incidence of vaccination for intestinal poisoning, which is a clear indicator of the change in the fodder consummated by the livestock, namely from dry fodder to green fodder due to re-emergence of pastures. The table also shows a decrease in the need of vaccination against infectious diseases such as Anthrax, Chickenpox and Brucella. Thus, reducing the rate of abortion and death in baby animals and mothers due to increased pastures. This is also due to the presence of medicinal plants within herbs that increase the immunity of livestock. This is a positive indicator that weather instability and the conditions associated with it are positive as they benefited the plants in general.



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Table (3): Number of animals treated against epidemic and infectious diseases (1455031) for 2018

(Report of the Directorate of Veterinary and Animal Health 13/2018)

Diseases	Sheeps	Goats	Cows	Camels	Horse Species	Dogs	Poultry and pet birds	Rabbits	Cats	Total
Alzora inflammation	35749	14679	3516	31	0	0	0	1	1	53977
Renal worms	277885	174864	1368	50	1	0	205	0	2	454375
Intestinal worms	280687	210735	5669	435	2	4	1558	80	0	499170
Blood parasites	21196	7046	119	663	0	0	0	0	0	29024
Scabies	22975	19494	2513	519	1	35	2	33	21	45593
Oestrus ovis	0	3	0	0	0	0	0	0	0	3
Soremouth	639	399	12	0	0	0	0	0	0	1050
Abortions	8225	7683	130	0	0	0	0	0	1	16039
Actinomycosis	29	29	44	0	0	0	27	12	0	141
Gastrointestinal toxicity	239600	49244	650	164	0	0	0	24	0	289682
Baldness	0	0	0	0	0	0	0	0	2	2
Liver Worms	8532	6368	218	0	0	0	0	0	0	15118
Fever tick	38028	12451	140	0	0	0	0	0	0	50619
Coccidia	54	12	1	0	0	0	171	0	0	238
Total	933599	503007	14380	1862	4	39	1963	150	27	1455031

Table (4): Number of vaccinated animals in the governorates of the Kingdom

Diseases	Sheep	Goats	Cows	Camel	Horse Species	Dogs	Cats	Rabbits	Poultry and pet birds	Total
Fever	1452711	280686	88833	0	0	0	0	0	0	1822230
Coal fever	150768	79408	3756	501	1079	0	0	0	0	235512
Small pox	1256494	280426	1757	0	0	0	0	0	0	1540465
Brucella	574055	137884	0	0	0	0	0	0	0	711939
Ruminant plague	2105410	374759	0	0	0	0	0	0	0	2480169
Gastro-intestinal poisoning	2171841	720762	62576	831	0	0	0	10	0	2956020
Rabies	0	0	0	0	0	52	0	0	24	76
Newcastle	0	0	0	0	0	0	34705	0	0	34705
Influenza	0	0	0	0	43	0	0	0	0	43
Nebocater	48978	9734	45	0	0	0	0	0	0	58757
Total	7760257	1883659	157145	2942	1122	52	34705	10	24	9839916



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Table (5): Treatment of non-communicable diseases in different animal species
(report of the Directorate of Veterinary and Animal Health 16/2018)

Pathological cases	Diseases Name	Sheeps	Goats	Cows	Camels	Horse Species	Dogs	Poultry and birds	Rabbits	Cats	Total
Mouth and teeth	Mouth and teeth	2368	1713	1113	43	9	0	0	0	0	5246
Poisoned	Poisoned	3319	2668	416	18		1	0	0	1	6423
Surgery	Injured dimples	2031	1772	864	9	54	7	3	0	12	4734
Skin	Dermatitis and eczema	1098	736	281	7	2	0	0	0	0	2124
Reproductive and urinary system	Restlessness	27	17	18	0	0	0	0	0	0	62
	Inflammation of the testicle	382	25	0	0	0	0	0	0	0	407
	Inflammation of the uterus	2923	3582	1038	1	0	0	0	0	0	7544
	Inflammation of urinary tract	55	128	3	1	0	0	0	0	0	187
	A uterine coup	184	217	11	9	2	0	0	0	0	423
	The coup of the vagina	46	56	1	0	0	0	0	0	0	103
	Polycystic ovaries	39	35	40	0	1	0	0	0	0	115
	Paul's inventory	638	317	91	15	20	3				1048
Respiratory system and blood circulation	Upper respiratory infection	2469	1418	437	0	15	5	1381		53	5778
	Pneumonia	130061	54379	3167	215	15	28	992		79	188936
Digestive System	Inflammation of the intestines and diarrhoea	86690	46301	1603	193	6	21	1123	12	71	136020
	Torsion and displacement of the fourth stomach	189	98	6	0	0	0	0	0	0	293
	Gasterataxia	2503	2005	1568	12	23	0	0	0	0	6111
	Foreign Body / Plastic	18	113	0	0	0	0	0	0	0	131
	Idle crunch	2	1	0	0	0	0	0	0	0	3
	Intestinal colic	8	12	0	0	0	0	0	0	0	27
	Blower	1892	1253	1289	3	0	0	0	3	5	4445
Metabolic cases	Toxicity of pregnancy	816	816	183	0	0	0	0	0	0	1815



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	Milk fever	115	97	56	0	0	0	0	0	0	268
	Blood solution	1q5	0	0	0	0	0	0	0	0	15
	Lack of vitamins and minerals	81050	56082	732	29	2		3		4	137902
Birth	Difficulty of birth	1370	1311	204	1	0	0	0	0	0	2886
Muscles and joints and lists	Inflammation	923	801	347	0	0	0	0	0	0	2071
	Inflammation of muscles	1444	693	45	22		2	0	0	0	2206
	arthritis	35605	27025	1351	56	22	1	0	0	3	64063
	Tinnitus	169	26		3		0	0	0	0	198
	General weakness	15724	18368	36	45	1	0	0	0	0	34174
	Limp	33	15	6	0	22	0	0	0	0	76
Eye and ear infections	Ear infection	903	309	120	0	0	1	0		2	1335
	Eye inflammation	3215	1989	695	28	11	2	5		30	5975
Against external parasites		2703823	1177588	92056	13722		93	2408	56	5	3989751
Total		3082147	1401966	107777	14432	205	164	5915	71	265	4612942

Table (6): Number of vaccinated animals in all governorates of the Kingdom
(report of the Directorate of Veterinary and Animal Health 15/2018)

Province	Fever			Rabies		Ruminants Plague		Brucellosis		Fever				
	Sheep	Goats	Cows	Dogs	Cats	Sheeps	Goats	Sheep	Goats	Sheep	Goats	Cows	Camels	Horses
Capital	289322	45523	150	318	0	209651	30766	0	65	0	0	0	435	0
Zarqa	192402	17901	25731	20	0	158477	15068	0	379	0	0	0	250	0
Balqa	54913	24553	64	0	0	32852	10923	0	0	0	0	0	27680	0
Madaba	150612	58789	263	57	0	109824	30648	0	24	0	0	0	0	0
Jordan Valley	134766	141674	1034	0	0	45262	10759	1303	98	1390	327	45	0	0
Irbid	321038	85942	24600	46	0	93459	17807	485	0	0	0	0	140	0
Ajloun	9649	32091	443	0	0	5290	15642	0	0	0	0	0	156	0
Jerash	18828	49387	1045	0	0	6654	11025	0	0	0	0	0	1500	0
Mafrq	513640	69328	8590	0	10	183397	7300	0	67	365641	3980	0	0	0
Karak	116236	33677	0	0	0	278275	75183	0	56	2001	600	0	2000	41
Maan	114987	28855	0	150	0	50466	13052	0	527	6687	4520	0	2500	0
Shara	103765	45076	0	20	0	14739	4824	0	0	2240	307	0	0	0
Tafileh	90447	18411	0	0	0	46041	5785	0	0	0	0	0	0	0
Aqaba	18369	27187	0	220	0	5326	6982	0	385	0	0	0	0	0
Petra	9930	21335	0	0	0	2111	3543	0	0	0	0	0	0	0
Northern Jordan Valley	16351	2324	650	0	0	3611	745	147	0	0	0	0	0	0
South Jordan Valley	16541	21700	0	0	0	11119	20374	0	0	0	0	0	50	0



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Table (7): Number of animal illnesses per governorates of the Kingdom

Province	Intestinal poisoning					Small pox				Nebocater			Newcastle	Influenza
	Sheep	Goats	Cows	Camels	Rabbits	Sheep	Goats	Cows	Camels	Sheep	Goats	Cows	Poultry and pet birds	Horses
Capital	289322	45523	150	318	0	209651	30766	0	65	0	0	0	435	0
Zarqa	192402	17901	25731	20	0	158477	15068	0	379	0	0	0	250	0
Balqa	54913	24553	64	0	0	32852	10923	0	0	0	0	0	27680	0
Madaba	150612	58789	263	57	0	109824	30648	0	24	0	0	0	0	0
Jordan Valley	134766	141674	1034	0	0	45262	10759	1303	98	1390	327	45	0	0
Irbid	321038	85942	24600	46	0	93459	17807	485	0	0	0	0	140	0
Ajloun	9649	32091	443	0	0	5290	15642	0	0	0	0	0	156	0
Jerash	18828	49387	1045	0	0	6654	11025	0	0	0	0	0	1500	0
Mafrq	513640	69328	8590	0	10	183397	7300	0	67	365641	3980	0	0	0
Karak	116236	33677	0	0	0	278275	75183	0	56	2001	600	0	2000	41
Maan	114987	28855	0	150	0	50466	13052	0	527	6687	4520	0	2500	0
Shara	103765	45076	0	20	0	14739	4824	0	0	2240	307	0	0	0
Tafileh	90447	18411	0	0	0	46041	5785	0	0	0	0	0	0	0
Aqaba	18369	27187	0	220	0	5326	6982	0	385	0	0	0	0	0
Petra	9930	21335	0	0	0	2111	3543	0	0	0	0	0	0	0
Northern Jordan Valley	16351	2324	650	0	0	3611	745	147	0	0	0	0	0	0
South Jordan Valley	16541	21700	0	0	0	11119	20374	0	0	0	0	0	50	0



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The Importance of Summer Pastures / A study on pastoral plants organized by Arab Organization
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- 8- The Benefits of Medicinal Plants
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- 10- Press releases, media statements and seminars made by the Director General of the General
Union of Jordanian Farmers, all of which are documented on Google.
- 11- Veterinary report issued by the Ministry of Agriculture for the year (2018)
- 12- Monthly veterinary reports issued by the Ministry of Agriculture for the year (2019)

Signature and Stamp of

Mahmoud Issa Oran

Director General of the General Union of Jordanian Farmers



Original Documents

In the Arabic language

Note: The Report of the Ministry of Water and Irrigation was written in English Language only



دائرة الارصاد الجوية

تقرير دائرة الأرصاد الجوية الأردنية سعادة المدير العام حسن المومني

السادة شركة القدرة للاستشارات البيئية

اشارة الى كتابكم رقم 3/أ.ج/2019 تاريخ 2019/5/13 والمتضمن تزويدكم بتقرير تقييمي لنهاية الموسم المطري وذلك بمقارنة المنطقة المستهدفة مع خارج المنطقة المستهدفة ، وكذلك التحاليل اللازمة للاتجاه العام بالمقارنة مع الثلاثين عام المنصرمة ، مرفقاً جداول الدراسة المطلوبة ادناه :

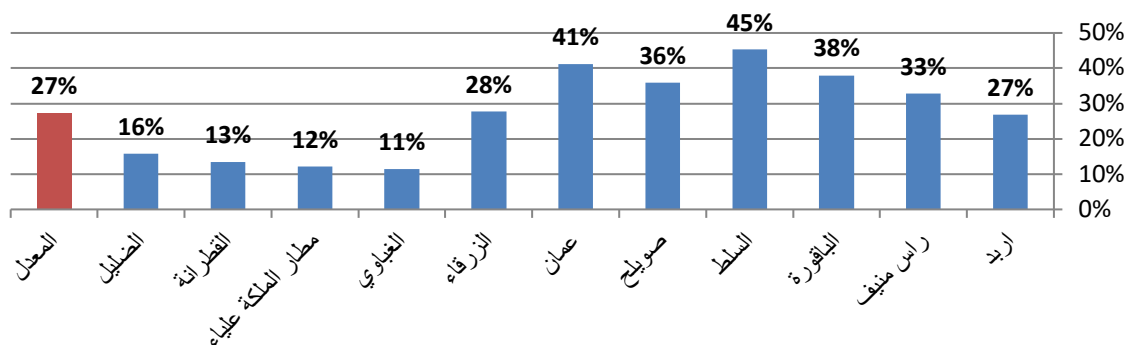
التقرير الاحصائي المطري موسم 2019/2018					
الموقع	المحطة	المجموع التراكمي الافتراضي / ملم	المجموع التراكمي الفعلي / ملم	اداء الفترة %	النسبة المئوية للزيادة او النقصان %
داخل المنطقة المستهدفة	اربد	449.2	569.8	127%	27%
	راس منيف	586.8	779.2	133%	33%
	الباقورة	388.0	536.8	138%	38%
	السلط	514.8	748.5	145%	45%
	صويلح	475.6	646.7	136%	36%
	عمان	245.6	346.8	141%	41%
	الزرقاء	125.2	159.9	128%	28%
	الغباوي	87.6	97.6	111%	11%
	مطار الملكة علياء	150.0	168.1	112%	12%
	القطرانة	96.8	109.8	113%	13%
	الضليل	133.4	154.5	116%	16%
المعدل		295.7	392.5	127%	27%

تبين من الجدول اعلاه للموسم المطري 2019/2018 **المنطقة المستهدفة** تبين ان اقل نسبة زيادة كانت (11%) واعلى نسبة زيادة كانت (45%) وبمعدل 27% زيادة عن المعدل الموسمي العام.



دائرة الارصاد الجوية

التقرير الاحصائي المطري موسم 2018/2019 (داخل المنطقة المستهدفة)

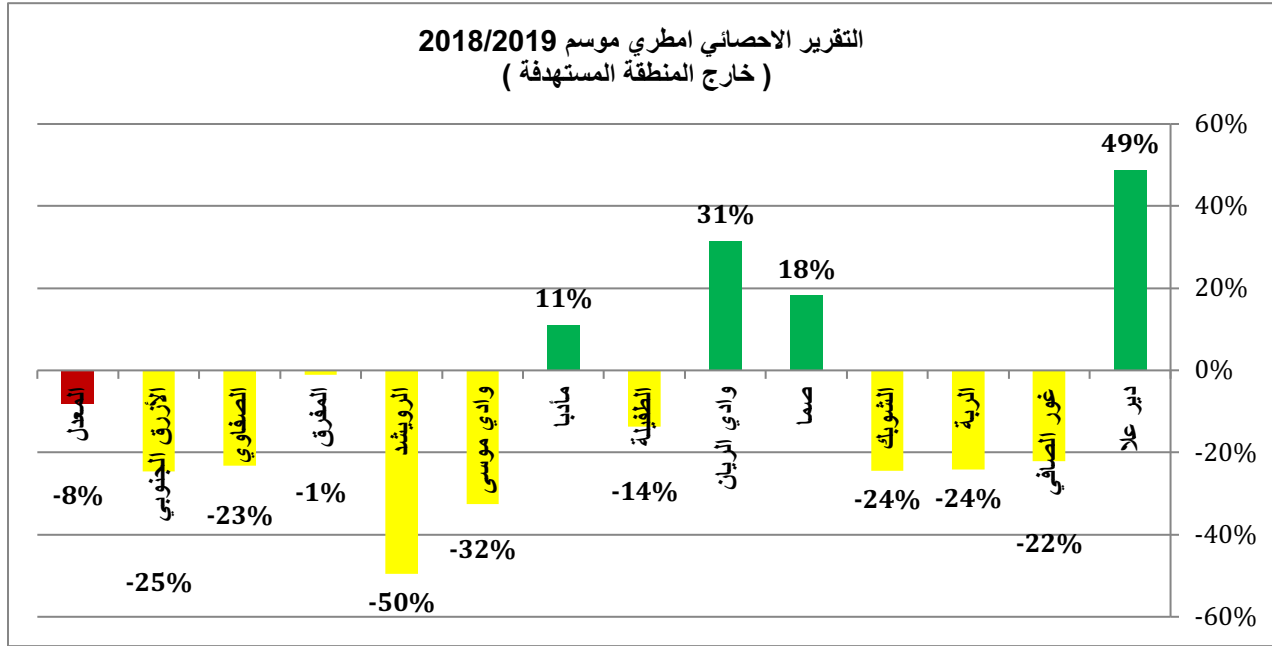


التقرير الاحصائي المطري موسم 2019/2018

الموقع	المحطة	المجموع التراكمي الافتراضي / ملم	المجموع التراكمي الفعلي / ملم	اداء الفترة %	النسبة المئوية للمؤدية او النقصان %
<u>خارج المنطقة المستهدفة</u>	دير علا	278.8	414.6	149%	49%
	غور الصافي	73.2	57.0	78%	-22%
	الرية	329.0	249.8	76%	-24%
	الشوبك	246.6	186.5	76%	-24%
	صما	438.2	518.3	118%	18%
	وادي الريان	310.1	407.6	131%	31%
	الطفيلة	191.5	165.2	86%	-14%
	مأدبا	326.6	362.7	111%	11%
	وادي موسى	172.4	116.4	68%	-32%
	الرويشد	77.3	39.0	50%	-50%
	المفرق	149.0	147.3	99%	-1%
	الصفواي	71.0	54.5	77%	-23%
	الأزرق الجنوبي	59.2	44.6	75%	-25%
<u>المعدل</u>		209.5	212.6	92%	-8%

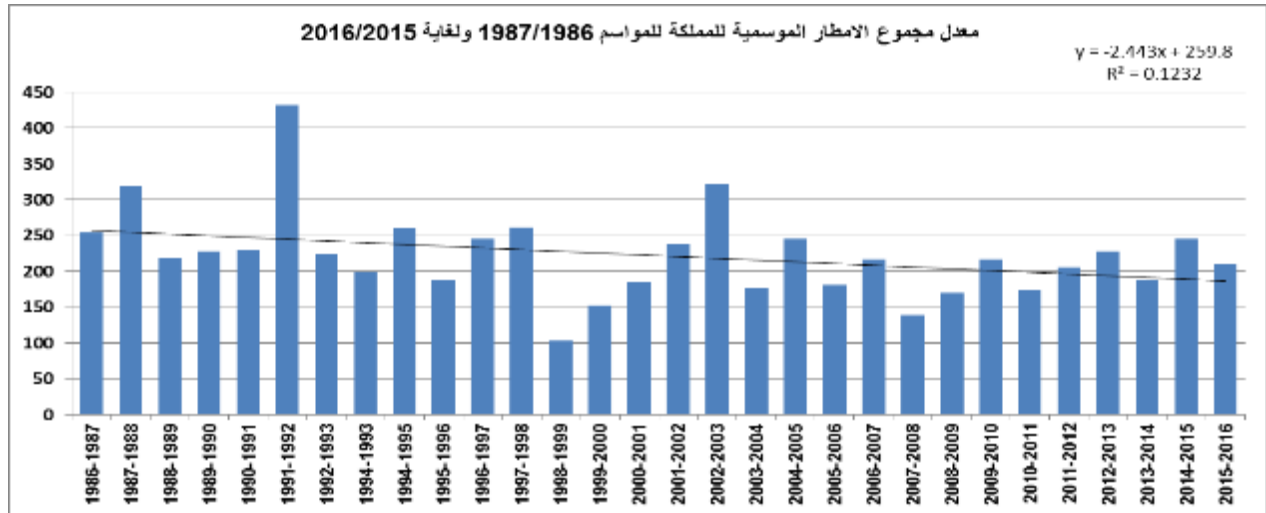


دائرة الارصاد الجوية



يتبين من الجدول اعلاه للموسم المطري 2019/2018 خارج المنطقة المستهدفة تبين ان اقل نسبة نقصان كانت -50% واعلى نسبة زيادة كانت 49% وبمعدل -8% وزيادة عن المعدل الموسمي العام. باعتبار نسبة الزيادة خارج المنطقة المستهدفة -8% عن المعدل العام للمنطقة هي الاساس المرجعي للمقارنة فتصبح معدل النسبة الحقيقية في الزيادة للمنطقة المستهدفة كالتالي: **27% داخل المنطقة المستهدفة - النسبة الحقيقية في الزيادة المستهدفة -8% خارج المنطقة المستهدفة = 35% زيادة في المنطقة المستهدفة عن المعدل الموسمي العام.** بالنسبة للمعدلات العامة للموسم المطرية في المملكة فقد تم بناء النموذج رقم (1) ادناه للمواسم المطرية (1987/1986 ولغاية 2016/2015) حيث يبين ان الاتجاه العام لمعدلات الهطول للمملكة بانخفاض سنوي بمقدار -2.443 ملم عن المعدل العام الموسمي .

نموذج رقم (1)



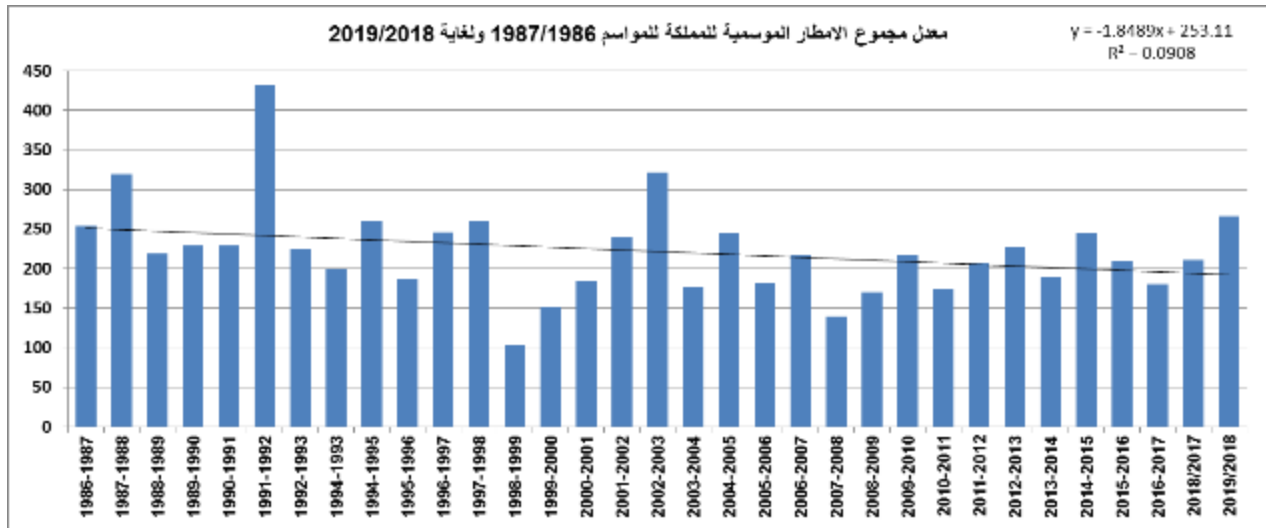


دائرة الارصاد الجوية

ويبين الجدول ادناه نموذج رقم (2) ان الاتجاه العام لمعدلات الهطول للمملكة بانخفاض سنوي بمقدار -1.8489 ملم عن المعدل العام الموسمي للمواسم (1987/1986 ولغاية 2019/2018)

نموذج رقم (2)

حيث نلاحظ ان هناك نقصان بمعدل انخفاض الاتجاه العام لمعدلات الامطار بمقدار (0.5941) ملم.





الاتحاد العام للمزارعين الاردنيين

تقرير اتحاد المزارعين الأردنيين معالي محمود عوران

في ظل التغيرات في معدلات الهطول المطري تقييم عام للواقع الزراعي في المملكة للفترة الزمنية ٢٠١٦ - ٢٠١٨

شهدت المواسم الثلاثة الماضية ٢٠١٦ - ٢٠١٨ تغيرات في مستويات الهطول المطري وبخاصة في المناطق الشمالية والوسطى من المملكة الأردنية الهاشمية تمثلت في زيادة في كميات الامطار وكذلك زيادة في عدد الأيام الماطرة حيث امتد الموسم المطري من بدايات فصل الخريف حتى نهاية فصل الربيع وذلك بحسب بيانات دائرة الأرصاد الجوية الأردنية. وكان للتغيرات في كميات وتوزيع الامطار آثاراً ايجابية لا يمكن تجاهلها على جميع القطاعات الحيوية وبخاصة قطاعات الزراعة والثروة الحيوانية في المملكة، الامر الذي يبشر ببداية تنميته مستدامه إذا ما استمر أداء المواسم المطرية على هذا النحو.

يعتمد هذا التقرير على الاحصائيات والبيانات المتوفرة لدى الجهات الرسمية المختلفة وعلى المشاهدات العينية والميدانية وكذلك على شهادات وتقارير المزارعين وذوي الاختصاص، والتي كان أهمها ما يلي:

- زيادة نسبة الغطاء النباتي الأخضر وتحديداً في المحاصيل الحقلية (القمح والشعير) وكذلك في الأعشاب والشجيرات الرعوية،
- ظهور نباتات طبية مفيدة كانت قد فقدت في السنوات الماضية،
- زيادة بنسبه ٣٠٪ في انتاج الأشجار البعلية التي تعتمد على مياه الامطار كمصدر أساسي ووحيد للري، ومنها الزيتون الذي يعتبر من اهم المنتجات الزراعية للمملكة،
- تراجع في ظهور الآفات والأمراض نتيجة الزيادة في الامطار وانخفاض درجات الحرارة،
- نمو نوعي وكمي في الثروة الحيوانية نتيجة زيادة في الغطاء النباتي والأعشاب البرية الطبية، الامر الذي ادي الي تحسن في صحة الحيوانات الرعوية وفي زيادة نسبة الخصوبة لدى الماشية وبالتالي الى ارتفاع عدد المواليد،
- انخفاض في تكلفه الإنتاج لدى المزارعين فيما يخص الاعلاف الجافه،
- تقليص كلفه الأدوية الوقائية والعلاجية التي تعطى للحيوانات،
- زيادة في كميات وجوده الالبان الحيوانية ومنتجاتها،
- انخفاض في الاعداد المستوردة للسوق المحلي من الماشية من مليون رأس الى ٣٠٠,٠٠٠ رأس، بنسبه ٧٠٪.



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وفيما يلي نستعرض اهم الآثار التي طرأت على القطاعات الحيوية المختلفة نتيجة الزيادة في الهطول المطري:

1-مياة الري والحفائر :

- تدفق المزيد من المياه الى البحر الميت نتيجة فيضانات السدود وارتفاع مستوى المياه في قناة الملك عبد الله .
- زيادة في منسوب المياه في الحفائر وخاصة في المناطق الشرقية بالمقارنة بالسنوات الماضية، مما ساهم في الاعتماد على هذه الحفائر في سقايه المواشي في موسم الصيف، وقد شجع هذا الامر على زياده الاستثمار في قطاع تربيته المواشي من قبل المزارعين.
- تفجر المياه من بعض الينابيع التي كانت قد جفت في السنوات الماضية وتحديداً في المناطق الشمالية والوسطى من المملكة .

٢-القطاع الزراعي:

كان لزياده كميات الامطار تأثير مباشر على القطاع الزراعي في المملكة ونستعرض فيما يلي اهم نتائج هذا التأثير:

ا-أشجار الزيتون :

على الرغم من ظاهرة تبادل الاحمال في شجرة الزيتون إلا أن المراقب يجد بأن كميات الزيتون الواردة إلى السوق المحلي ازدادت بشكل ملحوظ سواء كان زيتون مخصص لغايات التخليل أو زيت زيتون بعد إجراء عمليات العصر وتظهر الارقام بأن هناك زيادة متسارعه في الانتاج مقارنة بالسنوات الماضية.

ب- المحاصيل الحقلية :

تشير الارقام الصادرة عن دائرة الاحصاءات العامة بأن المحافظات الشمالية والوسطى للمملكة شهدت زياده ملحوظه في انتاج المحاصيل الحقلية مقارنة بالمحافظات الأخرى وذلك نتيجة لزياده خصوبه التربه بفعل الامطار . وكان لهذه الزيادة اثار إيجابية على النحو التالي:

- زياده الاقبال على الاستثمار في هذه المحاصيل من قبل المزارعين.
- قله الكميات المستورده من هذه المحاصيل وبخاصه الشعير.
- توفير المزيد من التبن المستخرج من هذه المحاصيل والذي يستخدم كأعلاف للماشيه الامر الذي أدى الى تناقص في استيراد هذا النوع من الأعلاف.
- أدت زياده كميات الامطار في بداية الموسم إلى زياده نسبه الرطوبه في التربه الامر الذي أدى بدوره الى سهوله والتكثير في حراثة وبذر الأراضي الزراعيه وبالتالي الى تحسين الموسم الزراعي.

ج -الاشجار المثمرة :

خلال السنوات الثلاث الماضية كانت هناك زياده ملحوظه على مستوى الجوده وكميه الإنتاج من الاشجار المثمره ، ويُعزى ذلك الى الوفرة في مياه الامطار في المناطق الزراعيه الامر الذي أدى إلى سهولة الاستفادة من الاسمدة سواء العضوية أو الكيماوية من جهة وحصول النباتات على ساعات برودة كافية وهي اللازمه لعملية الازهار وعقد الثمار من جهة أخرى.

تشير النتائج إلى ان المناطق الشماليه الغربيه للمملكه هي اكثر المناطق إنتاجاً للثمار وتحتل محافظة اربد المرتبة الأولى

في مساحة الاشجار المثمرة حتى عام 2017 تليها محافظة المفرق ومن ثم محافظتي جرش والزرقاء .



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د- النباتات الرعوية :

شهدت المناطق الشرقية والشمالية الشرقية والشمالية الغربية للمملكة زيادة نوعيه في نمو النباتات الرعوية والشجيرات والأعشاب نتيجة خصوبه الموسم وزيادة الامطار وبالتالي ارتفاع نسبه الرطوبه في التربه، وانعكس ذلك إيجابياً كما يلي:

- انتعاش في قطاع تربية المواشي التي تتغذى على هذه الأعشاب وبالتالي علي الثروه الحيوانيه في المملكة.
- تخفيض فاتورة الاعلاف الجافة من شعير ومواد علفية أخرى.
- توفير مزيد من الأعشاب والنباتات الطبيه التي تحتوي على العناصر الاساسيه لنمو المواشي بما في ذلك الفيتامينات وبعض الاملاح التي لا تتوفر في الاعلاف المصنعه والجافة مما انعكس إيجابياً على صحه واعداد المواشي كما يظهر في جدولي رقم ١ و ٢.
- ظهور بعض النباتات الطبيه والشجيرات الرعوية التي كانت نادرة الظهور في الماضي نتيجة تدني معدلات الهطولات المطرية واختفاء بعض ملامح فصل الشتاء.
- أدت الزيادة في حالات عدم الاستقرار التي شهدتها السنوات الثلاثه الماضيه والأمطار الغزيرة وظهور حالة البرق والرعد الناتجة عنها الى زياده في ظهور بعض النبات المرتبطة بهذه الأجواء مثل بعض انواع الفطر (الكماة والمشروم بجميع أنواعه).

٣-الثروة الحيوانية

كان للثروه الحيوانية نصيباً من التغيرات في الهطول المطري التي سادت في السنوات الثلاثه الماضيه حيث أدت زياده الامطار وما نتج عنها من زياده الغطاء النباتي ونمو الأعشاب والنباتات الطبيه في المناطق الرعويه الى تحسن ملحوظ في صحه المواشي وتناقص في الإصابة بالامراض التي كانت تظهر من قبل وتحديداً في أمهات الماعز والأغنام اضافة إلى صغار المواليد التي لم تصل إلى سن الفطام أو التي تبقى في القطيع للرعي مع الأمهات في المراعي، كما لوحظ تناقص في ظاهره اكل المواشي لاصواف بعضها البعض للتعويض عن نقص بعض الاملاح المعدنيه، الامر الذي يؤدي في النهايه الى نفوقها وهذا يعود إلى سببين : يجده الخبراء والباحثين نتيجة الاعتماد على الاعلاف الخضراء والنباتات الرعوية والتي هي بالأصل نباتات طبيه وعطرية لها علاقة بصحة الحيوان، وتدعم الجهاز المناعي لدى المواشي (نظر الجدول رقم ١).

جدول رقم (١) اعداد الحيوانات المحصنة ضد الأمراض المعدية والوبائية (قسم الصحة الحيوانية والاستقصاء الوبائي)

نوع الحيوان	اعداد الحيوانات المحصنة ضد الامراض المعدية والوبائية						
	2012	2013	2014	2015	2016	2017	2018
ضأن	5836733	5029452	5665397	5511871	7339095	8150868	7760257
ماعز	1679207	1468257	1569168	1396149	1830219	1972797	1883659
أبقار	76854	107679	113286	113726	118053	151019	157145
جمال	1822	1859	863	799	7508	1007	2942
خيول	664	612	693	461	976	832	1122
كلاب وقطط	4091	2493	1498	173	269	62	76
المجموع	7599371	6610452	7350905	7023179	9296390	10140585	98399156

يبين الجدول ان انتاج الضأن في السنوات الثلاثه الماضيه ازداد بنسبه تصل الى ٤٧٪ بالمقارنه مع السنوات التي سبقتها. وأظهرت النتائج ارتفاع لاعداد الضأن في المملكة حيث وصلت إلى ٧.٧ مليون رأس مقارنه ب ٥.٤ مليون رأس خلال السنوات التي سبقتها وتحفظ محافظة المفرق بأكبر عدد من الماشيه تليها محافظة العاصمة.



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٤-التنوع الحيوي

تشير الأرقام الصادرة عن مديريات البيطرة في المملكة في السنوات الثلاث الأخيرة إلى ظهور وتكاثر لبعض أنواع الحشرات والزواحف بشكل كبير مثل الفراش والافاعي، ويعزى الخبراء انتشار هذه الأنواع من الحشرات والزواحف إلى النمو في الغطاء النباتي وخاصة في المناطق الشمالية والوسطى من المملكة، حيث يساهم نمو وتكاثر الأعشاب والشجيرات الرعوية إلى خلق بيئة خصبة لوضع البويضات والتفقيس وبالتالي إعادة توازن التنوع الحيوي. (جدول رقم ٢).

جدول رقم (2) اعداد الحيوانات المحصنة ضد الأمراض المعدية والوبائية (قسم الصحة الحيوانية والاستقصاء الوبائي)

الجمال	الابقار	ماعز	ضأن	تعداد المواشي لعام ٢٠١٨
10872	60646	1026836	3496741	الحُمى القلاعية
0%	146.48%	27.33%	41.54%	طاعون المجترات الصغيرة
0%	0%	36.49%	60.42%	الجُدري
0%	2.89%	27.30%	35.93%	الحُمى الفحمية (الجُمرة الخبيثة)
4.60%	6.19%	7.73%	4.31%	الحُمى المالطية (بروسيل)
0%	0%	13.42%	16.42%	التسمم المعوي
7.64%	103.18%	70.10%	62.11%	

الجدول أعلاه يظهر ارتفاع حالات التطعيم للتسمم المعوي والذي هو مؤشر واضح على انتقال المواشي من الأعلاف الجافة إلى الأعلاف الخضراء بسبب إعادة ظهور المراعي. وكما يظهر الجدول تناقص في الحاجة للتطعيم ضد الأمراض المعدية كالانتركس والجُدري والبروسيل وبالتالي تدني نسبة الاجهاض والنفوق في صغار المواليد والامهات وذلك نتيجة لزيادة المراعي، كما يعزى ذلك لتواجد نباتات طبية ضمن الأعشاب التي من شأنها زيادة المناعة لدى المواشي. وهذا مؤشر ايجابي إلى أن حالات عدم الاستقرار الجوي، وما يرافقها من أحوال جوية هي حالات ايجابية وبها فائدة عامة على النباتات بشكل عام.

جدول رقم (٣) عدد الحيوانات المعالجة ضد الأمراض الوبائية والمعدية (١٤٥٥٠٣١) لعام ٢٠١٨ (تقرير مديرية البيطرة والصحة الحيوانية ١٣/ ٢٠١٨)

المرض	ضأن	ماعز	ابقار	ايل	فصيله خيليه	كلب	قطط	ارنب	دواجن وطيور زينه	المجموع
الحُمى القلاعية	1452711	280686	88833	0	0	0	0	0	0	1822230
الحُمى الفحمية	150768	79408	3756	501	1079	0	0	0	0	235512
جُدري	1256494	280426	1757	0	0	0	0	0	0	1540465
البروسيل	574055	137884	0	0	0	0	0	0	0	711939
طاعون المجترات	2105410	374759	0	0	0	0	0	0	0	2480169
التسمم المعوي المعدي	2171841	720762	62576	831	0	0	0	10	0	2956020
داء الكلب	0	0	0	0	0	52	0	0	24	76
نيوكاسيل	0	0	0	0	0	0	34705	0	0	34705
انفلونزا	0	0	0	0	43	0	0	0	0	43
نيوباكتر	48978	9734	45	0	0	0	0	0	0	58757
المجموع	7760257	1883659	157145	2942	1122	52	34705	10	24	9839916

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جدول رقم (٤) عدد الحيوانات المحصنة في محافظات المملكة

المرض	الحصنة القلاعية			الحصنة المالطية		طاعون المجترات		داء الكلب		الحصنة القلاعية		
	ضأن	ماعز	ابقار	ضأن	ماعز	ضأن	ماعز	كلاب	قطط	ضأن	ماعز	ابقار
العاصمة	117623	50169	15326	10975	23894	75538	56119	0	0	15326	50169	15326
الزرقاء	151592	8166	27952	5225	4758	51287	10961	0	0	27952	8166	27952
البلقاء	46187	18375	548	890	7495	31953	14138	0	0	548	18375	46187
مادبا	132631	9476	176	33235	6941	37281	23210	0	0	176	9476	132631
وادي الأردن	71555	18026	1231	8214	5443	26194	31066	0	0	1231	18026	71555
اربد	479478	55957	23656	15164	24912	44668	20387	24	39	23656	55957	479478
عجلون	5879	20688	869	4205	115455	4310	19596	0	9	869	20688	5879
جرش	9225	19027	613	863	2415	1195	67095	0	0	613	19027	9225
المفرق	165175	15975	17248	0	9022	84008	35703	0	4	17248	15975	165175
الكرك	163537	12330	70	63974	14357	76024	41384	0	0	70	12330	163537
معان	41484	8066	39	0	7783	103164	3690	0	0	39	8066	41484
إقليم الشراه	12960	4247	0	0	5209	21350	6747	0	0	0	4247	12960
الطفيلة	27633	7972	7	1560	9239	6135	61350	0	0	7	7972	27633
العقبة	2405	5890	0	0	3010	2057	9033	0	0	0	5890	2405
البتراء	7111	10717	0	150	415	227	10310	0	0	0	10717	7111
الاغوار الشمالية	7904	1327	1102	2535	390	3820	7860	0	0	1102	1327	7904
الاغوار الجنوبية	1032	14278	2	5338	4825	1740	17325	0	0	2	14278	1032

جدول رقم (٥) معالجة الأمراض غير المعدية في مختلف أنواع الحيوانات (تقرير مديرية البيطرة والصحة الحيوانية 2018/16)

المرض	ضأن	ماعز	ابقار	جمال	فصيله خيليه	كلب	دواجن وطيور زينه	ارانب	قطط	المجموع
التهاب الظفر	35749	14679	3516	31	0	0	0	1	1	53977
ديدان رنوية	277885	174864	1368	50	1	0	205	0	2	454375
ديدان معوية	280687	210735	5669	435	2	4	1558	80	0	499170
طفيليات الدم	21196	7046	119	663	0	0	0	0	0	29024
جرب	22975	19494	2513	519	1	35	2	33	21	45593
نغف انف	0	3	0	0	0	0	0	0	0	3
البثور الجلدي المعدي	639	399	12	0	0	0	0	0	0	1050
اجهاضات	8225	7683	130	0	0	0	0	0	1	16039
الفطر الشعاعي	29	29	44	0	0	0	27	12	0	141
التسمم المعوي	239600	49244	650	164	0	0	0	24	0	289682
قراخ	0	0	0	0	0	0	0	0	2	2
ديدان كبدية	8532	6368	218	0	0	0	0	0	0	15118
حما قراد	38028	12451	140	0	0	0	0	0	0	50619
كوكسيديا	54	12	1	0	0	0	171	0	0	238
المجموع	933599	503007	14380	1862	4	39	1963	150	27	1455031

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15/2018 (تقرير مديرية البيطرة والصحة الحيوانية جدول رقم (٦) أعداد الحيوانات المحصنة في كافة محافظات المملكة)

الحالة المرضية	المرض أسم	ضأن	ماعز	ابقار	جمال	فصيله خيليه	كلاب	دواجن وطيور زينه	ارانب	قطط	المجموع
الفم و الأسنان	الفم و الأسنان	2368	1713	1113	43	9	0	0	0	0	5246
تسمم	تسمم	3319	2668	416	18		1	0	0	1	6423
جراحة	جروح مختلفة دمامل	2031	1772	864	9	54	7	3	0	12	4734
جلد	التهاب جلد واكرزما	1098	736	281	7	2	0	0	0	0	2124
جهاز تناسلي و بولي	احتباس مشيمه	27	17	18	0	0	0	0	0	0	62
	التهاب خصيه	382	25	0	0	0	0	0	0	0	407
	التهاب رحم	2923	3582	1038	1	0	0	0	0	0	7544
	التهاب مسالك بوليه	55	128	3	1	0	0	0	0	0	187
	انقلاب رحم	184	217	11	9	2	0	0	0	0	423
	انقلاب مهبل	46	56	1	0	0	0	0	0	0	103
	تكيس مبايض	39	35	40	0	1	0	0	0	0	115
	حصر بول	638	317	91	15	20	3				1048
جهاز تنفسي ودورة دموية	التهاب الجهاز التنفسي العلوي	2469	1418	437	0	15	5	1381		53	5778
	التهاب رئوي	130061	54379	3167	215	15	28	992		79	188936
جهاز هضمي	التهاب امعاء واسهال	86690	46301	1603	193	6	21	1123	12	71	136020
	التواء واراحة المعدة الرابعة	189	98	6	0	0	0	0	0	0	293
	تخممة/ تلبك	2503	2005	1568	12	23	0	0	0	0	6111
	جسم غريب/ بلاستيك	18	113	0	0	0	0	0	0	0	131
	خمول كرش	2	1	0	0	0	0	0	0	0	3
	مغص معوي	8	12	0	0	0	0	0	0	0	27
	نفاخ	1892	1253	1289	3	0	0	0	3	5	4445
حالات استقلابية	تسمم حمل	816	816	183	0	0	0	0	0	0	1815
	حمى حليب	115	97	56	0	0	0	0	0	0	268

3 -Year Report Rainfall Enhancement in Jordan



الاتحاد العام للمزارعين الاردنيين

15	0	0	0	0	0	0	0	0	1q5	حلوثة الدم	
137902	4		3		2	29	732	56082	81050	نقص فيتامينات و معادن	
2886	0	0	0	0	0	1	204	1311	1370	ولادة عسر ولادة	
2071	0	0	0	0	0	0	347	801	923	عضلات و مفاصل و قوائم	
2206	0	0	0	2		22	45	693	1444	التهاب عضلات	
64063	3	0	0	1	22	56	1351	27025	35605	التهاب مفاصل	
198	0	0	0	0		3		26	169	التهاب وتر	
34174	0	0	0	0	1	45	36	18368	15724	ضعف عام	
76	0	0	0	0	22	0	6	15	33	عرج	
1335	2		0	1	0	0	120	309	903	التهاب اذن	عين واذن
5975	30		5	2	11	28	695	1989	3215	التهاب عين	
3989751	5	56	2408	93		13722	92056	1177588	2703823	مكافحة طفيليات خارجية	
4612942	265	71	5915	164	205	14432	107777	1401966	3082147	المجموع	

انفلونزا	نيوكاسل	شويكنز			جدري				التسمم المعوي					المحافظة
		دواجن وطيور زينه	ابقار	ماعز	ضأن	جمال	ابقار	ماعز	ضأن	ارانب	جمال	ابقار	ماعز	ضأن
0	435	0	0	0	65	0	30766	209651	0	318	150	45523	289322	العاصمة
0	250	0	0	0	379	0	15068	158477	0	20	25731	17901	192402	الزرقاء
0	27680	0	0	0	0	0	10923	32852	0	0	64	24553	54913	البلقاء
0	0	0	0	0	24	0	30648	109824	0	57	263	58789	150612	مادبا
0	0	45	327	1390	98	1303	10759	45262	0	0	1034	141674	134766	وادي الأردن
0	140	0	0	0	0	485	17807	93459	0	46	24600	85942	321038	اربد
0	156	0	0	0	0	0	15642	5290	0	0	443	32091	9649	عجلون
0	1500	0	0	0	0	0	11025	6654	0	0	1045	49387	18828	جرش
0	0	0	3980	365641	67	0	7300	183397	10	0	8590	69328	513640	المفرق
41	2000	0	600	2001	56	0	75183	278275	0	0	0	33677	1j16236	الكرك
0	2500	0	4520	6687	527	0	13052	50466	0	150	0	28855	114987	معان
0	0	0	307	2240	0	0	4824	14739	0	20	0	45076	103765	إقليم الشراه
0	0	0	0	0	0	0	5785	46041	0	0	0	18411	90447	الطفيله
0	0	0	0	0	385	0	6982	5326	0	220	0	27187	18369	العقبة
0	0	0	0	0	0	0	3543	2111	0	0	0	21335	9930	البتراء
0	0	0	0	0	0	147	745	3611	0	0	650	2324	16351	الاغوار الشمالية
0	50	0	0	0	0	0	20374	11119	0	0	0	21700	16541	الاغوار الجنوبية



الاتحاد العام للمزارعين الاردنيين

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اعداد المهندس

محمود موسى العوران

مدير عام الاتحاد العام للمزارعين الاردنيين

For any additional information please contact:

Hatem Al Halabi
Director of Quality & institutional development
Jordan Meteorological Department
Hatem_met@hotmail.com

للمزيد من اي معلومات الرجاء التواصل مع:

حاتم الحلبي
مدير الجودة والتطوير المؤسسي
دائرة الأرصاد الجوية الأردنية
Hatem_met@hotmail.com