

# Monarch Butterfly Biosphere Reserve

## 2020 Conservation Outlook Assessment

### SITE INFORMATION

**Country:** Mexico

**Inscribed in:** 2008

**Criteria:** (vii)



The 56,259 ha biosphere lies within rugged forested mountains about 100 km northwest of Mexico City. Every autumn, millions, perhaps a billion, butterflies from wide areas of North America return to the site and cluster on small areas of the forest reserve, colouring its trees orange and literally bending their branches under their collective weight. In the spring, these butterflies begin an 8 month migration that takes them all the way to Eastern Canada and back, during which time four successive generations are born and die. How they find their way back to their overwintering site remains a mystery. © UNESCO

### SUMMARY

#### 2020 Conservation Outlook

Finalised on 02 Dec 2020

##### SIGNIFICANT CONCERN

The conservation outlook for the World Heritage site with respect to its outstanding natural phenomenon and flagship species is one of significant concern. While recent all-time lows in wintering population sizes may have been aggravated by severe weather conditions, there are broader trends of loss and degradation of breeding and feeding habitat in the United States of America and Canada due to the expansion of industrial agriculture and land development associated loss of host plants. While some of these concerns require management responses at a scale beyond site and even national level, even the factors that can be influenced at site level are not fully under control. While illegal logging has decreased significantly thanks to increased law enforcement measures, it still occurs. The dramatic decline in the overwintering colonies in 2013-2014 to just 0.67 ha caused serious concerns over the survival of the monarch butterfly migration phenomenon; however, the colonies recovered again in the following years to 4.01 ha in 2015-2016, although then slightly declined again in 2016-2017 (2.91 ha) and in 2017-2018 (2.48 ha). While it is difficult to determine the trend yet, there is hope that the recovery from the all-time low can be further sustained. However, this will require stronger efforts, both locally and across the entire range of the monarch butterfly.

## FULL ASSESSMENT

### Assessment information

#### Threats

---

##### Current Threats

Very High Threat

Current threats to the site's OUV include loss and degradation of forests, ongoing illegal small-scale logging, and poorly managed tourism. Climate change impacts have already been visible, particularly through damage caused by severe weather events, but concerns also exist about the longer-term impacts, including through possible reduction of suitable areas for the overwintering colonies.

► **Logging/ Wood Harvesting**

High Threat

*(Legal and illegal logging)*

Inside site, localised (<5%)  
Outside site

From 2001 through 2013, 1254 hectares were deforested in the monarch reserve, 934 ha were degraded, and 126 ha were affected by climatic conditions (Vidal et al., 2014). Of the total 2195 ha of affected (deforested and degraded forest) area, 2066 ha were affected by illegal logging: 1507 ha by large-scale logging and 558 ha by small-scale logging.

Mexican authorities effectively enforced efforts to protect the site from illegal logging, particularly from 2007 to 2012. Those efforts, together with the decade-long financial support from Mexican and international philanthropists and businesses to create local alternative-income generation and employment, resulted in the decrease of large-scale illegal logging from 731 ha affected in 2005-2007 to 9 ha affected in 2013, although small-scale logging is of growing concern (Vidal et al., 2014).

However, despite those efforts 32.47 hectares were affected by illegal logging, mainly small-scale logging, between 2014 and 2017. But only 1.4 ha were affected by illegal logging in 2017-2018 (State Party of Mexico, 2018).

Overall, illegal logging within the site has decreased significantly since 2008 thanks to the implemented measures (IUCN, 2018).

► **Livestock Farming / Grazing**

High Threat

*(Agriculture and livestock keeping)*

Inside site, extent of threat not known  
Outside site

Agricultural use continues to threaten the World Heritage site in multiple ways. Agricultural encroachment in the buffer zones reduces the extent of available forest habitat required by the butterfly colonies. Grazing and associated intentional burning increases the risk of forest fires. Furthermore, water diversion for agriculture is reported to be a concern (Brower, 2013; UNEP-WCMC, 2011). The situation is complicated due to the tenure arrangements which include land rights within the site. The forests in the buffer zones have been, and continue to be, degraded significantly by unsustainable forest exploitation, fires, grazing, and agricultural expansion, all of which would eventually play a key role in further degrading the already degraded and particularly vulnerable core zones (Vidal et al., 2014).

► **Tourism/ visitors/ recreation**

High Threat

*(Poorly regulated tourism and visitation)*

Inside site, scattered (5-15%)  
Outside site

The site is a major tourist attraction with a great potential for local economic benefits, conservation financing and visitor education. In the last 30 years, the six sanctuaries opened for visitors have been visited by more than 2,6 million tourists, with an average of 120,000 per year in recent years (IUCN, 2018). The potential has not been fully realized and concerns about damage and disturbance caused by tourists persist. The numbers and behavior of visitors threatens the monarch colonies (Vidal and Rendon-Salinas, 2014). Groups of tourists have been seen approaching the colonies too close, breaking the butterfly clusters and forcing them to move to areas nearby. This has been repeatedly documented in colonies that are open to tourists (Cerro Prieto, Sengio, El Rosario, El Capulín, La Mesa, and San Mateo

Almomoloa) and in colonies not open to tourists (the federal property, and the Michoacán state property) (Vidal and Rendon-Salinas, 2014). Since monarchs apparently do not feed when they overwinter in Mexico, they depend on their lipid reserves, and when the butterflies are disturbed regularly by tourists throughout the season, they are forced to fly more often and spend their energy reserves, which would affect their ability to migrate north. Tourists may also increase the risk of accidental fires. Some progress has been achieved in addressing this issue. A code of conduct and further regulations have been developed to limit potential negative impacts, for example, through limiting the time that groups can stay in the butterfly colonies area (IUCN, 2018).

► **Habitat Shifting/ Alteration**

*(Climate change)*

**Very High Threat**

Inside site, throughout(>50%)  
Outside site

Climate change and extreme weather conditions are already affecting the World Heritage site itself, but also the butterfly habitat across the USA and Canada.

Between 2009 and 2011, 115 hectares of forest in the monarch reserve were affected by floods, strong winds, droughts, and fires, and 29 ha more were affected by drought and parasitic plants in 2012 and 2013 (Vidal et al., 2014).

Severe rain, snow and freezing temperatures caused mass mortalities of monarchs in the overwintering sites in 1981, 1992, 2002 and 2004, but particularly in March 2016. A severe storm and snowfalls in March 2016 also caused severe damage to many forest areas within the Biosphere Reserve (IUCN, 2018). Of concern is also the fact that climate change might be affecting the distribution of plant species that important for the Monarch butterflies, particularly the Oyamel fir, which has been found particularly vulnerable to changing climatic conditions (Sáenz-Romero et al., 2012).

► **Other**

*(Habitat loss and alterations within the broad range of habitats required for the life and migration cycle)*

**Very High Threat**

Inside site, extent of threat not known  
Outside site

It is important to understand that factors beyond the control of site management and even directly the State Party can fundamentally influence the key natural phenomenon making the site so exceptional. The monarch butterfly is susceptible to habitat change, climate change and agrochemicals throughout its range, including migration corridors.

Widespread reduction of the breeding habitat of the butterflies, particularly in the Corn Belt region of the USA due to land use changes and the decrease of this butterfly's main larval food plant (common milkweed, *Asclepias syriaca*) associated with the use of glyphosate and other herbicides are also responsible for the dramatic decline in the number of monarchs in the hibernation colonies in Mexico (Vidal and Rendon-Salinas, 2014; Vidal et al., 2014).

**Potential Threats**

**High Threat**

It is important to understand that factors beyond the control of site management and even directly the State Party can fundamentally influence the key natural phenomenon making the site so exceptional. The monarch butterflies are susceptible to habitat change, climate change and agrochemicals throughout their range, including migration corridors.

► **Mining/ Quarrying**

*(Mining/ Quarrying)*

**High Threat**

Outside site

There have been several attempts (April 2005, May 2007, and more recently in November 2013) by the mining company Sociedad Industrial Minera Mexico ("Proyecto Angangueo") to re-activate the exploitation of copper, zinc, silver and gold in the vicinity of the World Heritage site and within the Monarch Butterfly Biosphere Reserve (which is larger than the World Heritage site). The most recent IUCN reactive monitoring mission to the site (2018) confirmed the position of CONANP that no authorization for mining with the Biosphere Reserve will be given. However, the threat remains as a number of mining concessions remain overlapping with the World Heritage site and discussions about potential reopening of the Angangueo mine continue (IUCN, 2018).

## Protection and management

---

### Assessing Protection and Management

- **Management system** **Some Concern**

The World Heritage site is the core zone of the Monarch Butterfly Biosphere Reserve, which is managed by Comisión Nacional de Áreas Naturales Protegidas (CONANP). In addition, 13 NGOs and academic institutions and the Monarch Butterfly Trust Fund (co-managed by the Mexican Fund for Nature and WWF-Mexico) provide inputs to management. Management is guided by a Management Program, a general document that lays out policies on sustainable development, wildlife management, public use, scientific research and monitoring, operations and law enforcement, rather than specific prescriptions for management. The document forms the basis for the Annual Operational Plans that are used to guide the day-to-day management activities of the many organizations involved (IUCN, 2008; State Party of Mexico, 2011).
- **Effectiveness of management system** **Data Deficient**

The National Commission on Natural Protected Areas (CONANP) has been undertaking an evaluation of the management effectiveness of all or most federal protected areas, through its Sistema de Informacion, Monitoreo y Evaluacion para la Conservacion (SIMEC, <https://simec.conanp.gob.mx/evaluacion>). However, no information specifically on this site is available.
- **Boundaries** **Some Concern**

The site's boundaries are defined by Presidential Decree declaring a biosphere reserve at the national level in 2000. The three defined core zones of the biosphere reserve constitute the World Heritage site while the two buffer zones of the biosphere reserve also serve as the buffer zones of the site. Jointly, the core zones cover 14 of the historically-recorded overwintering colonies of the eastern population of the Monarch Butterfly. The remaining populations hibernate in 5 colonies outside the World Heritage site and some colonies have been lost altogether (Brower, 2013; Vidal and Rendon-Salinas, 2014; Vidal et al., 2014). While the boundaries of the World Heritage site are adequate for the protection of around 80% of the overwintering population of the monarch butterfly, the overwintering colonies outside the site should be considered as a serial extension in the future (IUCN, 2008), particularly in the face of changing climatic conditions (IUCN, 2018).
- **Integration into regional and national planning systems** **Some Concern**

An Advisory Council, made up of 21 representatives of rural cooperatives, communities and NGOs, has been established to assist CONANP in implementing the Management Program and Annual Operational Plans. At a broader scale, a Regional Committee has been established to integrate the efforts of the States of Michoacán and México and 27 municipalities in developing and implementing a regional land use plan (IUCN, 2008).

Besides regional and national coordination, international cooperation is also an important factor for the conservation of this site. A Trinational Working Group, established by Canada, Mexico and the USA in 2014, developed short- and long-term targets and activities for preservation of the migration of the monarch butterfly (State Party of Mexico, 2017).
- **Relationships with local people** **Some Concern**

Almost all of the World Heritage site is located on communal lands or private property. Conservation and management programs must be implemented through cooperative activities with the landowners. Considerable efforts have been underway to promote alternative livelihood projects, environmental education and training, compensation schemes for conservation, reforestation, and voluntary surveillance to halt illegal logging (Vidal and Rendon-Salinas, 2014; Vidal et al., 2014; State Party of Mexico, 2011; IUCN, 2018). The government's payment for environmental services, and the financial support from Mexican and international philanthropists and businesses that helped to create alternative

incomes and employment for local communities, together with the Monarch Fund, have played a key role to reduce illegal logging by providing incentives for the communities to protect their forests. Conflicts remain in terms of the use of the "ejido" lands within the World Heritage site. Given widespread rural poverty, incentives to log and collect firewood remain high. There are also concerns about benefit-sharing in the realm of tourism.

About 27,000 people live in 93 agrarian communities within the reserve's buffer zones and more than 1 million people live around the reserve. Formerly based on mining and forestry, the economy of the monarch butterfly region faces serious economic challenges, mostly in the form of scarce and poorly paid jobs (Vidal et al., 2014). Dire regional social and economic problems remain, and they must be addressed to ensure the reserve's long-term conservation.

► **Legal framework**

**Some Concern**

Building upon earlier national designations, in 2000, the "Reserva de la Biosfera Mariposa Monarca" was established and in 2007 the same area was formally designated as a biosphere reserve under UNESCO's Man and the Biosphere (MAB) Programme. In 2008, the core zones of the biosphere reserve were inscribed as a World Heritage site. Of 19 butterfly colonies reported to date, 14 are in the federal Reserve and thus protected, 3 are in a protected area in Estado de Mexico, and 2 are in Michoacán state and not protected (Vidal and Rendon-Salinas, 2014).

► **Law enforcement**

**Some Concern**

From 2001 through 2012, 1254 ha of forest within the Reserves' core zones were deforested and 925 ha were degraded by illegal logging activities. Of the total 2179 ha of affected area, 2057 ha were affected by illegal logging: 1503 ha by large-scale logging and 554 ha by small-scale logging. Mexican authorities effectively enforced efforts to protect the monarch reserve, particularly from 2007 to 2012. Those efforts, together with the decade-long financial support from Mexican and international philanthropists and businesses to create local alternative-income generation and employment, resulted in the decrease of large-scale illegal logging from 731 ha affected in 2005–2007 to none affected in 2012, although small-scale logging is of growing concern (Vidal et al., 2014).

Between 2014–2016, 30.92 hectares were illegally logged in the core zone; actions were taken by the federal government and in August 2016 the first group (80 elements) of the Environmental Gendarmerie was permanently installed in the core zones. In coordination with the Federal Attorney for Environmental Protection (PROFEPA), they have carried out operations at strategic sites to dismantle illegal sawmills and have patrolled the core zones (State Party of Mexico, 2017). Overall, illegal logging has significantly decreased since 2007, however, it still occurs (IUCN, 2018).

► **Implementation of Committee decisions and recommendations**

**Some Concern**

The most recent World Heritage Committee Decision (2019) included a number of requests, including those related to continuing efforts to combat illegal logging, ensuring that no mining activities are permitted within the World Heritage site or in its vicinity and increasing trilateral cooperation with Canada and the USA to minimize threats to the monarch butterflies along their migration route (World Heritage Committee, 2019). Measures to address these requests are ongoing, however, their effectiveness will need to be further evaluated at a later stage.

► **Sustainable use**

**Some Concern**

Significant funding has been provided to work with local and indigenous communities in the core and buffer zones of the biosphere reserve to develop a wide range of activities as alternatives to logging of the core zones, i.e. the World Heritage site (State Party of Mexico, 2011). Financial support by national and international organizations and private sector is significant (see, for example, the WWF-Carlos Slim Foundation Alliance and WWF-Telcel monarch program; [www.wwf.org.mx](http://www.wwf.org.mx)).

► **Sustainable finance**

**Some Concern**

Financing has been provided by several federal, state and international sources from governments, private sector, philanthropists and civil society. While the diverse funding sources are positive,

challenges exist in terms of inter-institutional coordination. The Monarch Butterfly Fund (MBF), established and managed by the Mexican Fund for Nature and WWF-Mexico has a long term endowment which has been supported by the federal and state governments, civil society (international and national), and individual donors (State Party of Mexico, 2011; [www.wwf.org.mx](http://www.wwf.org.mx)).

► **Staff capacity, training, and development**

**Some Concern**

Several programs have contributed to staff training and development, but given that several federal and state government institutions, and civil society organizations are involved in management, the training and development of staff remains a considerable challenge. This holds true in particular as regards specialized capacities for monitoring of the butterfly overwintering colonies, tourism, and visitor management (IUCN, 2008; State Party of Mexico, 2011).

► **Education and interpretation programs**

**Some Concern**

A large number of projects have been undertaken related to environmental education for local communities. Guide training has been an important component (State Party of Mexico, 2011).

► **Tourism and visitation management**

**Some Concern**

While some concerns remain about possible negative impacts of tourism on the overwintering colonies due to disturbance by visitors, a code of conduct and further regulations have been developed to better manage visitation (IUCN, 2018).

► **Monitoring**

**Mostly Effective**

Forest cover, forest condition, and monarch butterfly colonies are monitored on a regular basis by CONANP, WWF, jointly with scientists (IUCN, 2008; Carranza Sánchez, 2010; Vidal and Rendon-Salinas; Vidal et al. 2014). Five biological monitoring programs are currently being carried out (State Party of Mexico, 2017), the two most important of which are the monitoring of monarch butterfly hibernation colonies and the monitoring of the forest cover in the Reserve's core zones (both lead jointly by WWF-Mexico, the Monarch Reserve and the National Autonomous University - UNAM; see Vidal and Rendon-Salinas 2014; Vidal et al. 2014).

► **Research**

**Mostly Effective**

The overwintering sites were a scientific mystery until 1975 when, after decades of butterfly tagging a site was last found on Cerro Pelón. Many studies have ensued, from North American universities, and more recently by Mexican scientists and conservation organizations (Vidal and Rendon-Salinas, 2014). The butterfly species has prompted research into migration ecology, pest suppression, geo-magnetism and other factors influencing orientation, and their use as environmental indicators over its migration range (UNEP-WCMC, 2011).

## **Overall assessment of protection and management**

► **Assessment of the effectiveness of protection and management in addressing threats outside the site**

**Some Concern**

Most threats originate from outside the World Heritage site. Of these, many can still be considered local challenges, and these have been the focus of most protection and management activities. However, probably the most important threat (destruction of breeding, feeding and migratory habitat) originate across the migratory route of the monarch, particularly in the USA.

## **State and trend of values**

---

## Summary of the Values

- ▶ **Assessment of the current state and trend of World Heritage values**

**Trend: Data Deficient**

## Additional information

### Benefits

---

#### Understanding Benefits

- ▶ **Importance for research**

The numerous studies on the species and its migration, as well as on working with the local ejidos and indigenous communities, have provided scientific insights into several fields, such as plant-animal interactions, migration ecology, interactions among stake-holders, etc.

- ▶ **Outdoor recreation and tourism**

Visitation to the site is significant and growing, and is an important source of income for local communities. Visitation to the site also benefits the regional and national tourism industry though its importance is relatively small compared to other tourism attractions.

- ▶ **Water provision (importance for water quantity and quality)**

The protection of watersheds upstream of communities and dams in the buffer zones is an important benefit, especially in the face of climate change (Caranza Sanchez, 2010). This include large neighbouring cities such as Toluca and even Mexico City.

Factors negatively affecting provision of this benefit :

- Climate change Impact level - High, Trend - Continuing

#### Summary of benefits

The World Heritage site provides major benefits through the conservation of a spectacular natural phenomenon, as a major touristic and scientific resource, and through watershed protection which is of importance to communities in the buffer zones of the site - and to millions of people in nearby cities, including Mexico City.

### Projects

---

#### Compilation of active conservation projects

<b>Nº</b>	<b>Organization</b>	<b>Brief description of Active Projects</b>	<b>Website</b>
-----------	---------------------	---	----------------

---

1	Alliance WWF-Telcel and Alliance WWF-Carlos Slim Foundation, Yves Rocher Mexico and France, WWF & Fondo Mexicano para la Conservación de la Naturaleza, A.C. (FMCN) WBF, Biocenosis	WWF-Telcel and WWF-Carlos Slim alliances – and their many national and international partners, have since 2003 support numerous sustainable development projects on communal tree nurseries, reforestation, eco-tourism, communal local surveillance, making and selling of handicrafts, etc., as well as monitoring of forest cover and monarch butterfly colonies. Monarch Butterfly Trust Fund Training of guides; training of environmental education teachers.	<a href="http://www.wwf.org.mx/">http://www.wwf.org.mx/</a> <a href="http://www.biocenosis.org.mx">www.biocenosis.org.mx</a> <a href="http://www.fundacioncarlosslim.org">www.fundacioncarlosslim.org</a>
2	MBF, CONAFOR	Payments to landowners as compensation for conservation of private lands within the property; and reforestation.	<a href="http://www.monarchbutterflyfund.org">www.monarchbutterflyfund.org</a> <a href="http://www.conafor.gob.mx">www.conafor.gob.mx</a>
3	Fondo Mexicano para la Conservación de la Naturaleza, A.C. (FMCN)	Restoration of landslide and erosion areas.	<a href="http://fmcn.org/">http://fmcn.org/</a>
4	FONATUR	Improvement of tourism infrastructure in the buffer zone of the biosphere reserve.	<a href="http://www.fonatur.gob.mx">www.fonatur.gob.mx</a>
5	CONANP/ PROCODES, PET	Sustainable tourism program, which supports the development of infrastructure and training of local communities inside the property.	<a href="http://www.conanp.gob.mx/acciones/procodes.php">http://www.conanp.gob.mx/acciones/procodes.php</a>
6	Commission for Environmental Cooperation of North America (CEC; U.S.A, Canada, and Mexico)	Development and implementation of the North American Monarch Conservation Plan with a focus on (1) prevention of threats, mitigation, and control; (2) innovative cooperative agreements; (3) research, monitoring, evaluation and development of reports; and (4) education, training, and capacity building.	<a href="http://www.cec.org/">http://www.cec.org/</a>
7	PROFEPA, MBF, PROCODES	Development of voluntary surveillance brigades to halt illegal deforestation.	<a href="http://www.profepa.gob.mx/">http://www.profepa.gob.mx/</a>
8	MBF, Aztec Movement	Alternative livelihoods for communities in the Monarch Butterfly Biosphere Reserve.	.

## REFERENCES

### Nº References

- 1 Brower, L. P., Castilleja, G.; Peralta, A.; Lopez-García, J.; Bojorquez-Tapia, L.; Díaz, S.; Melgarejo, D.; Missrie, M. 2002. Quantitative changes in forest quality in a principal overwintering area of the Monarch Butterfly in Mexico, 1971-1999. *Conservation Biology* 16(2):346-359.
- 2 Brower, L.P. 2012. Report on 4 day visit to the Monarch Butterfly Biosphere Reserve. Memo.
- 3 Brower, L.P. 2013. Trip to the Monarch Butterfly overwintering site in Mexico (16 - 23 February 2013).
- 4 Brower, L.P.; Taylor, O.R.; Williams, E.H.; Slayback, D.A.; Zubieta, R.R.; Ramírez, M.I. 2012. Decline of monarch butterflies overwintering in Mexico: is the migratory phenomenon at risk? *Insect Conservation and Diversity*. Volume 5, Issue 2, pages 95-100.
- 5 Carranza Sanchez, J. Paniagua Ruiz, I.; Ocegüera Salazar, K. A.; Ruiz Paniagua, L. 2010. Análisis del impacto por la 5ª tormenta invernal del 2010, en la Reserva de la Biosfera Mariposa Monarca ante el cambio climático global. Comisión Nacional de Áreas Naturales Protegidas.
- 6 Flockhart, D.T.T., J.-B. Pichancourt, D.R. Norris and T.G. Martin. 2014. Unravelling the annual cycle in a migratory animal: breeding-season habitat loss drives population declines of monarch butterflies. *J. Anim. Ecol.*, 10.1111/1365-2656.12253
- 7 Fondo Mexicano para la Conservación de la Naturaleza – Comisión Nacional de Áreas Naturales Protegidas. 2010. Estimación y Actualización al 2009 de la Tasa de Transformación del Hábitat de las Áreas Naturales Protegidas SINAP I y SINAP II del FANP. Reserva de la Biósfera Mariposa Monarca.
- 8 Government of Mexico. 2017. State of Conservation Report by the Government of Mexico..
- 9 IUCN, 2008. World Heritage Nomination. IUCN Technical Evaluation of Monarch Butterfly Biosphere Reserve, Mexico. ID No. 1290.
- 10 IUCN. (2018). Reactive Monitoring Mission Report Monarch Butterfly Biosphere Reserve (Mexico). [online] Gland, Switzerland: IUCN. Available at: <https://whc.unesco.org/en/list/1290/documents/> (Accessed 3 October 2019).
- 11 Oberhauser, K.S.; Cotter, D.; Davis, D.; Décarie, R.; Behnnumea, A.E.; Galino-Leal, C.; Gallina Tessaro, M.P.; Howard, E.; Lauriault, J.; Maczieski, W.; Malcolm, S.; Martínez, F.; González, J.M.; McRae, M.; Nernberg, D.; Pisanty-Baruch, I.; Ramírez, I.; Reyes, J.J.; Wilson, V. 2008. North American Monarch Conservation Plan. Commission for Environmental Cooperation, Montreal, Canada.
- 12 State Party of Mexico (2011). State of Conservation report.
- 13 State Party of Mexico. (2018). Report of the State Party to the World Heritage Committee on the state of conservation of Monarch Butterfly Biosphere Reserve (Mexico). [online] Government of Mexico. Available at: <https://whc.unesco.org/en/list/1290/documents/> (Accessed 3 October 2019).
- 14 UNEP/WCMC. 2011. World Heritage Information Sheet.
- 15 UNESCO. (2019). Report on the State of Conservation of Monarch Butterfly Biosphere Reserve, Mexico. State of Conservation Information System of the World Heritage Centre. [online] Paris, France: UNESCO World Heritage Centre. Available at: <https://whc.unesco.org/en/soc/3916> (Accessed 3 October 2019).
- 16 UNESCO. 2017. Monarch Butterfly Biosphere Reserve Mexico
- 17 Venegas Pérez, Y., Rodríguez, S.; López, D.T. 2011. Análisis Base para el diseño de la Estrategia de Reforestación de la Reserva de la Biosfera Mariposa Monarca. Michoacán, México. Monarch Butterfly Fund – Dirección de la Reserva de la Biosfera Mariposa Monarca.

**Nº References**

---

- 18 Vidal, O. and E. Rendon-Salinas. 2014. Dynamics and trends of overwintering colonies of the monarch butterfly in Mexico. *Biological Conservation*. Volume 180, December 2014, Pages 165-175
- 
- 19 Vidal, O., J. López-García and E. Rendón-Salinas. 2014. Trends in deforestation and forest degradation after a decade of monitoring in the monarch butterfly biosphere reserve in Mexico. *Conserv. Biol.*, 28 (2014), pp. 177-186.