

Dr. Lincoln Brower trip to the monarch butterfly overwintering  
area in Mexico, 16 -23 February 2013

3 March 2013

I traveled to Mexico in February 2013 in order to visit several monarch butterfly overwintering colonies and also to help my colleague from Emory University, Jaap de Roode, lead a visit by former President Jimmy Carter and his wife Rosalynn to the Piedra Herrada monarch butterfly overwintering site. Unfortunately, Jaap had to cancel his trip at the last minute. Below is a description of my visit to the butterfly region from 16 - 23 February 2013. The trip included a rewarding day with President Carter, followed by research visits to the logged Lomas de Aparacio area, the Sierra Chincua and Cerro Pelon.

I flew into Mexico City on Saturday and was met by UNAM graduate student/colleague Raul Zubieta and joined up with Michael Maudsley and Amanda Pierce from Jaap's laboratory. We then drove westward to the Avandaro Hotel and Golf Spa near Valle de Bravo where we would meet President and Mrs. Jimmy Carter and their entourage of what we estimated were 35 Secret Service folks guarding them. Arrangements for the Carters were hush-hush for security reasons. The plan was that we would split into three groups and meet at the butterfly colony at 10:30AM on Sunday. The first group included President Carter (Mrs. Carter unfortunately was ill and could not join the group), several secret service folks, Aja Bonsu, the Scientific Attaché from the US Embassy and Felipe Martinez, Sub-director of the Monarch Butterfly Biosphere Reserve. Felipe is an ornithologist and led the Carter group on an early morning bird watching hike before we arrived. Our second group included World Wildlife Fund monarch biologist Eduardo Rendon, Monarch Butterfly Fund educator Eneida Montesinos, and the new Monarch Butterfly Biosphere Reserve Director, Gloria Travera Alonso. We joined this group around 9:30 AM at the ecotourism center at the base of Piedra Herrada and our two groups rode on horses on a steep trail, arriving at the base of the colony around 10:15 AM. We ascended the mountain in swirling clouds of dust and the heavy horse and tourist impact has led to extensive elimination of understory vegetation along the trail and adjacent to the colony. We also noticed the installation of a plastic water pipe draining water away from the colony, depriving the butterflies of critical moisture. On our return to the visitor center, we passed more than 50 horses and noted 24 huge passenger busses parked nearby. An official sign along the trail stated that there is a limit of 20 visitors at a time to the colony. In

violation of their own edict, hugely excessive numbers of tourists are visiting this monarch butterfly overwintering colony.

The Carter group ascended the mountain from the north side and the three groups met at the colony at 10:40 AM (19°11.092'N by 99° 57.817'W; elevation 3056 m). President Carter spotted me immediately and thus began a memorable experience over the rest of the day. I had sent him copies of several of our research papers and it was evident that he had carefully read them all. He asked incisive questions and was concerned why the numbers of butterflies are down this year. I told him that bad weather in the summer of 2012 had impacted the breeding, that logging in Mexico had deteriorated overwintering conditions in many areas, and that the genetically engineered herbicide-resistant corn and soybean crops are eliminating milkweed and nectaring habitats on an unprecedented scale where most of the monarchs breed in the Midwestern United States (Brower et al., 2011). This led to our discussion of the pros and cons of GMO crops in general and he told me that cotton growing on his farm in Georgia had been overwhelmed by the boll weevil and required multiple sprayings until GMO-weevil resistant plants were introduced. So, he emphasized, balance is needed. After he picked up several dead monarchs from the ground, we discussed natural bird predation in the colony. He was very accommodating to all the folks taking pictures. After a half an hour or so, the Carter party returned to their horses and headed down the mountain. We learned afterwards that, because of the severe steepness of their trail on the north side, Aja had fallen over the head of her horse and another horse fell on one of the secret service agents. LPB did not tell the official trip organizers that if they had listened more closely to our experienced group, their party would have been able to ascend and descent the mountain safely without incident. Fortunately, President Carter did not suffer the same fate.

Next in our schedule was to meet in President and Mrs. Carter's villa to make four short power point presentations of our monarch and conservation research activities. Knowing of their interest in bird-watching, I presented a summary of our work on how birds are able to break through the chemical defenses of the monarch, and I then presented some of our findings on the importance of maintaining an intact oyamel forest to assure the microclimate needs of the monarch. President Carter listened intently and asked informed questions about monarch and, bird biology and the conservation issues. Next was Amanda Pierce from Jaap de Roode's lab who presented their recent molecular genetics findings establishing that the eastern and western populations of the monarch, contrary to prior belief, are a genetically homogeneous population. This is relevant to the conservation issues because

if the eastern population collapses, it is likely that the western population will, too. Eneida Montesinos then presented a summary of her work in training the local ejidatarios who serve as monarch tourist guides. Eduardo Rendon finished up the talks with a summary of the achievements of the World Wildlife Fund-Mexico (WWF-Mexico) and Monarch Butterfly Biosphere Reserve efforts to monitor the colonies, and to reduce illegal logging in the Reserve. He has been forbidden to divulge information on the status of the total area (combined colony hectares) occupied by the monarchs this year until officially released by WWF-Mexico. I surmised that the combined overwintering area this season will hit a 19 year record low with a value of less than 2 hectares.

After our lectures, we joined President Carter at dinner. He had arrived in the dining room before me, and on my appearance, he grasped my hand and led me to our table to sit on his left, with Gloria Tavera Alonso on his right. Dinner conversation was sparkling. I had read two of his 29 books and asked him about his youth in Plains, Georgia, and then about his post-presidential activities in eliminating the dreaded river blindness and Guinea worm diseases in Africa. We also discussed the US Supreme Court action on Corporate Personhood and he told me it was the worst decision ever made by the Court. I had a personal family tale to share with him, and as I recounted the story, he lit up like a light bulb. The day was a highlight in all our lives. The next morning we observed the President viewing birds on the hotel golf course while being shadowed by the secret service walking about the area with their "golf bags."

On Monday (18 February 2013), Raul and I left the Carter group and headed to the city of Zitacuaro to meet with our UNAM colleague, Dr .Isabel Ramirez, her post-doctoral Associate, Pablo Jaramillo, and her two students, Ruffi Jacabo and Lydia Salas. We then proceeded to the Lomas de Aparacio area in the heart of the Monarch Butterfly Biosphere Reserve on the south side of Sierra Campanario (19° 29.308'N by 100° 12.281'W; elevation 3022 m.). Between 2004 and 2008, 450 hectares of Oyamel fir forest were illegally devastated in this area by clear cutting that eliminated several colony sites (Simmon et al., 2008). In the past few years, the Mexican government has undertaken replanting operations that we all judged are very likely more damaging to the Oyamel recovery than allowing natural regeneration to occur. The government replanting protocol is to dig deep rectangular holes supposedly to reduce erosion, but in fact the exposed surface area increases soil desiccation; observed tree survival rates are poor. Also, there is no control over from where the seeds originated that produce the nursery seedlings. It is important that they be collected locally

because of the extremely high endemicity of the flora in this region of Mexico (Cornejo-Tenorio, 2003). After the enlightening day of observing the former clear-cutting and what we consider poor reforestation methodology in the Reserve, we proceeded to dinner and overnight at Alternare, an NGO based near Angangueo that promotes environmental education and sustainable agriculture in the butterfly region.

The next morning (19 February 2013) our objective was to travel to the base of Arroyo Hondo and walk up the western face of the Sierra Chincua, an area that has hosted monarch colonies since they were first discovered by Kenneth and Cathy Brugger in 1975 (Urquhart, 1976; Brower, 1995). Our objective was to see if the new road built up the arroyo to facilitate construction of more than 40 dams after the severe flooding of 31 January – 2 February 2010 was being used for access by loggers (major dam at base of Arroyo Hondo, 19° 40.177' N by 100° 19.004' W; elevation 2695 m). The good news was that we saw no new logging, but the road is being used by local trucks. This can lead to extensive illegal logging in the future, as has happened in the past. We shall recommend to the MBBR that the road be closed because Arroyo Hondo is one of the two principal exit routes for the spring remigration of monarchs overwintering in this critical Sierra Chincua overwintering massif. We also noted that the area was extremely dry and that the road reconstruction had disrupted several flows and water seeps where monarch butterflies by the millions drink later in the season (BBC, 2008). About half way up the arroyo, we encountered small numbers of monarchs flying down the canyon, and as is typical, later in the afternoon, flying back up. A few monarchs were drinking on the road where a small amount of water flowed out of the main arroyo stream channel. The dryness of the area was also reflected in severe desiccation of the understory *Senecio* and *Eupatorium*, herbaceous understory plants that are native nectar sources for the monarchs. An ominous development was the recent installation of another large plastic pipe that will be used to drain water out of the stream for domestic and agricultural use.

The following day (20 February 2013) was again crystal clear and we returned to the crest of the Sierra Chincua via the main Chincua Station entrance and visited the colony at around 1:30 PM (19° 40.51'N by 100°17.917'W; elevation 3293 m). The effects of the severe drought (locals stated that there had been no precipitation since 16 January 2013) and damage by extensive horse access for the tourists were again evident. A dry wind gusting up the slope from the west was further desiccating the monarchs. The colony was located slightly below the Mojonera Alta rock premonitory where it has frequently occurred in the past, and, as spring

advances, is the position from which the colony will gradually move down into Arroyo Hondo where we visited yesterday. The colony was located on a steep slope in a disturbed forest area where blow-downs of numerous oyamel trees had occurred in the recent past. We counted only 10 Oyamel trees with branch clusters and none of the trees had trunk clusters. Our guide, Abel Valdez Martinez, told us that there was a second colony that had split off from this colony prior to our visit and had moved slightly further down slope. He estimated that this offshoot colony included about 30 trees with clusters. I was shocked by the small size of the combined colony areas that was likely less than 0.10 hectares. In the late 1970's and early 1980's, multiple colonies occurred in this area of the Sierra Chincua and ranged up to more than 3 ha in area (Calvert and Brower, 1986), 30 times larger than what we saw today.

The following day (21 February 2013) was again crystal clear and we drove to Macheros at the south side of Cerro Pelon to visit one or two colonies reported to be located on the west face of the mountain. One of the sites occurred in the ravine adjacent to the north side of the Llano de Aserradero and the other that we saw was higher up ( $19^{\circ} 23.417'N$  by  $100^{\circ}16.362'W$ , elevation 3050 m) near Carditos. The horse ride up to Carditos was extremely arduous and the logging trail we had to descend to Aserradero was too steep and rocky for riding the horses. As a result, we were forced to walk down the treacherous slope, a straight-line distance of about 1.2 km and a vertical drop of 301 m. Over the past 20 years, the whole west slope of Cerro Pelon has been horse-logged by locals who carry in their chain saws and skillfully convert the large pine and oyamel trees into boards, which they then haul out with horses. Almost all of the large trees have been illegally logged out of the area, and over the years the loggers have worked their way up slope to within meters of the remaining mature forest that shelters the Carditos colony. The colony we found (location above) was dispersed and tiny and had less than 10 trees with monarch clusters. Several trees immediately adjacent to the cluster trees had been recently lumbered. After descending to the Llanos de Aserradero, we did not visit the second colony, which our local experienced guide, Melquiades Moreno, said was also small (approximate coordinates and elevation to be added if others have the data). As we all discussed the logging issues, a horse logger dragging out timber passed by us.

We determined the following day that no colony formed this year on the slope leading down to the Llano de los Tres Gobernadores on the south face of Cerro Pelon. Colonies frequently form at the head of the arroyo that originates immediately west of this Llano, near the stream source known as Ojo de Agua ( $19^{\circ} 22.974'N$  by  $100^{\circ}15.768'W$ ; elevation 2967 m.). This

arroyo runs down the south face of Cerro Pelon and crosses under the highway just below the Village of Macheros (19° 21.297'N by 100° 17.178'W; elevation 2348 m). In years when there is a colony, millions of monarchs fly down this arroyo and cross the highway on their way to drink water.

The main purpose of our visit to the Pelon areas was for a group of scientists and an expert nurseryman (1) to observe the ongoing illegal logging; (2) to discuss inducing the Mexican government to put an end to the horse logging that has been going on for about 20 years (Calvert, and Brower, personal observations); and (3) to advise the government and the new Monarch Butterfly Biosphere Reserve Director, Gloria Travera Alonso, on the best way to allow the area to recover. We were all pleased to discover that the huge area on this west face of Pelon from which the mature oyamel and pines have been logged is recovering by the natural regeneration of both tree species. Our discussion group included Dr. Isabel Ramirez from UNAM-Morelia, Dr. Edgardo Hernandez from the Autonomous University of Chapingo, Joes Luis Alvarez, a commercial nurseryman and director of the La Cruz Habitat Protection Project, Lincoln Brower, Professor of Zoology, emeritus, of the University of Florida, and Pablo Span, manager of the Cayetano Hotel in Huetamo near Zitacuaro and frequent visitor to the area. We unanimously agreed that the best way to regenerate this forest towards optimal monarch butterfly overwintering habitat is to protect it from any further logging and to allow it to continue its natural recovery that is already well underway.....*not* to reforest it with nursery cultivated seedlings.

The next day, 22 February 2013, Brower, Zubieta and Span, drove to the town of Xoconusco and then up the south face of Cerro Pelon to the Llano de los Tres Gobernadores. Our mission was to look for evidence of monarch colonies and to check on the current status of illegal logging in the area. We first drove to the forest on the northeast side of the Llano (19°22.976'N by 100°15.194'W, elevation 2949 m). A cursory inspection of the understory vegetation indicated the presence of only one blooming plant species, an herbaceous Senecio. All the other plants were drought stressed and not blooming. We were shocked to see how dry the Llanos was. Except for the very western end of the area where there is a local spring seep, the vast expanse of the Llano was brown and desiccated. In October 2005, an extensive illegal logging had recently occurred in this area of the forest, and numerous large Oyamel had been cut and removed while many others had been left on the ground (Brower and Slayback, personal observations; Aridjis, 2005) We visited this area again in March 2012 and found no additional logging operations. This year, however, extensive salvage logging of the trees had occurred with very heavy trucking over several new roads threading through the forest.

We found this operation an appalling continuation of the illegal logging in the supposedly completely protected core area of the Reserve. This south face of Cerro Pelon and the adjacent area surrounding the Llano de los Tres Gobernadores is one of the most pristine areas remaining in the Monarch Butterfly Biosphere Reserve. Our guide, Vicente Moreno Rojas, who is from Macheros, told us that the trucks were transporting the logged trees to Santa Teresa, located to the northeast of the Llano. For the authorities to continue to ignore such a major logging operation is a travesty.

Based on our cursory observations of the small sizes of the colonies and their dispersed states, together with the extreme drought conditions (also noted in Pruden and Morris, 2013), I predict that the remigration into the US this spring may be perilously low. Given the heavy impact of tourism and horses on the butterfly colony areas and the trails leading to them, the ever increasing installation of pipes capturing the water from the natural seeps and spring sources near the colonies, the continued cumulative impact of horse logging, the ever-present small scale logging that is rampant in the area, the frequent presence of grazing cattle and sheep, the authorized removal of trees by salvage logging that causes extensive soil compaction, the misguided methods of replanting seedlings, and what appears to be increasing desiccation, the future of the monarch butterfly overwintering phenomenon in Mexico is seriously compromised. The slope of graph of the year-by-year total colony area is pointing to zero (Brower et al, 2012) and may soon be there. Potential good news is that the Reserve Director Gloria Travera is aware of the problems and has promised to address them (Brower, personal communication, 21 February 2013).

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