

Candidates must complete this page and then give this cover and their final version of the extended essay to their supervisor.

Candidate session number

Candidate name

School number

School name

Examination session (May or November)

May

Year

2012

Diploma Programme subject in which this extended essay is registered: Geography
(For an extended essay in the area of languages, state the language and whether it is group 1 or group 2.)

Title of the extended essay: To what extent does global warming affect the Monarch butterfly migration from Northern U.S.A. to the Anganjveo Mountain in Mexico and how does this influence the surrounding towns politically and economically?

Candidate's declaration

This declaration must be signed by the candidate; otherwise a grade may not be issued.

The extended essay I am submitting is my own work (apart from guidance allowed by the International Baccalaureate).

I have acknowledged each use of the words, graphics or ideas of another person, whether written, oral or visual.

I am aware that the word limit for all extended essays is 4000 words and that examiners are not required to read beyond this limit.

This is the final version of my extended essay.

Candidate's signature:

Date: January 19th 2012

Supervisor's report and declaration

The supervisor must complete this report, sign the declaration and then give the final version of the extended essay, with this cover attached, to the Diploma Programme coordinator.

Name of supervisor (CAPITAL letters) _____

Please comment, as appropriate, on the candidate's performance, the context in which the candidate undertook the research for the extended essay, any difficulties encountered and how these were overcome (see page 13 of the extended essay guide). The concluding interview (viva voce) may provide useful information. These comments can help the examiner award a level for criterion K (holistic judgment). Do not comment on any adverse personal circumstances that may have affected the candidate. If the amount of time spent with the candidate was zero, you must explain this, in particular how it was then possible to authenticate the essay as the candidate's own work. You may attach an additional sheet if there is insufficient space here.

_____ began the process by illustrating a keen interest in his topic. I initially advised that his topic was quite broad and he decided to focus upon a specific local area in Mexico. I was also concerned that the content of his essay could result in an investigation for biology rather than geography and he took heed of my advice.

During the viva voce, _____ acknowledged that there is a lack of data which has then led to a quite basic level of analysis but he was pleased with the content for the effects of climate change upon the butterflies. He followed a plan to collect data and he tried to contact tourism-related organizations in Mexico in order to assess the impacts from a reduction in migration but he received no replies. No further approaches were made and thus there is limited data which proved to be a big challenge for his analysis. He tried to include a geographical test within his analysis although _____ did not fully understand how this could raise the level of his argument. The focus of his essay changed a little in terms of location but there was no consideration of changing his title further after realizing that he was not able to gather significant data. This is a shame since _____ illustrated his passion for the subject at various times throughout the whole process, including the viva voce.

_____ was proactive in arranging meetings and communicating with me. It should be noted that _____ first language is German so there are some issues with his spelling and grammar.

This declaration must be signed by the supervisor; otherwise a grade may not be issued.

I have read the final version of the extended essay that will be submitted to the examiner.

To the best of my knowledge, the extended essay is the authentic work of the candidate.

I spent hours with the candidate discussing the progress of the extended essay.

Supervisor's signature _____

Date: 20th January 2012

Assessment form (for examiner use only)

Candidate session number

Achievement level

Criteria	Examiner 1	maximum	Examiner 2	maximum	Examiner 3
A research question	1	2	2	2	
B introduction	1	2	1	2	
C investigation	2	4	2	4	
D knowledge and understanding	2	4	2	4	
E reasoned argument	2	4	2	4	
F analysis and evaluation	2	4	1	4	
G use of subject language	2	4	2	4	
H conclusion	1	2	1	2	
I formal presentation	2	4	2	4	
J abstract	2	2	2	2	
K holistic judgment	1	4	1	4	
Total out of 36	18		18		

Name of examiner 1: _____
(CAPITAL letters)

Examiner number: _____

Name of examiner 2: _____
(CAPITAL letters)

Examiner number: _____

Name of examiner 3: _____
(CAPITAL letters)

Examiner number: _____

IB Cardiff use only: B: _____

IB Cardiff use only: A: 100836

Date: 22/5

To what extent does global warming affect the Monarch butterfly migration from Northern U.S.A. to the Angangueo Mountain in Mexico and how does this influence the surrounding towns politically and economically? A1.

May 2012

Geography

Word Count: 3755

Abstract:

The following essay is about the monarch butterflies and how global warming affects their migration. The research question is: To what extent does global warming affect the Monarch butterfly migration from Northern U.S.A. to the Angangueo Mountain in Mexico and how does this influence the surrounding towns politically and economically? ✓

To answer this question I mainly did research on the internet. To find primary information I sent an email to multiple organizations with questions about my topic, however I did not get any answers back. I gathered general information about the butterflies to write the introduction and then the main threats are written in the beginning of the investigation. Global warming and its effects on the monarchs were then clearly described and analyzed. ✓

In summary, the monarch butterflies are in threat of extinction in 50 years, due to global warming. Increased rainfall and cold waves are expected in Mexico in the future, which could wipe out the entire population of monarchs. ✓

J2 ✓

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Introduction:

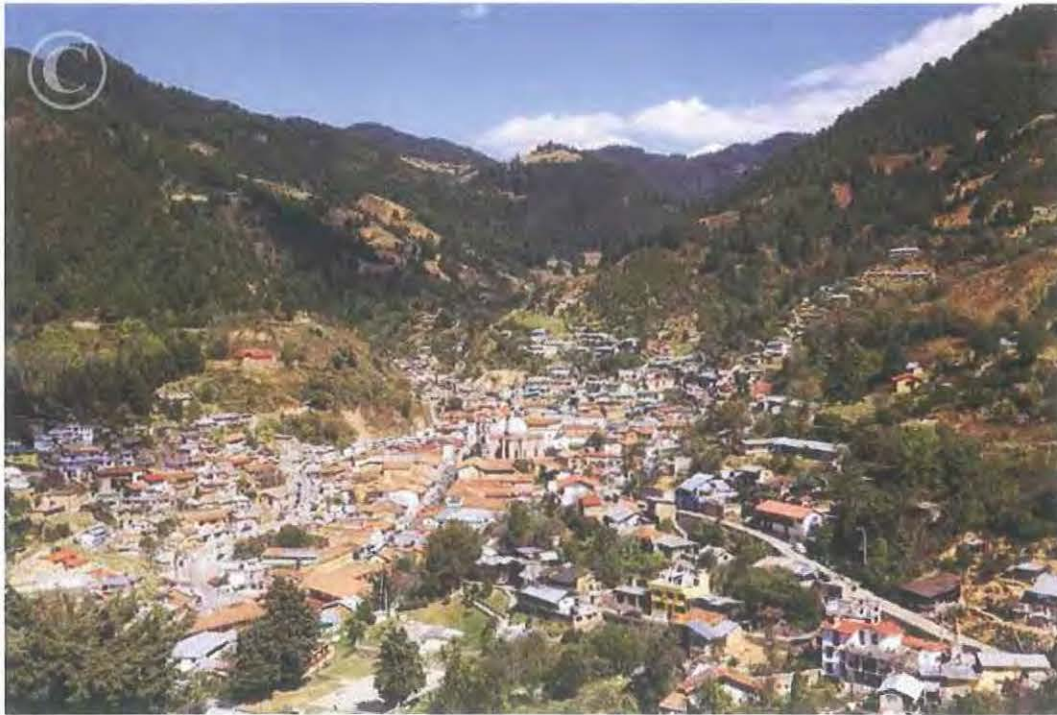
For many years now, Monarch butterflies have been migrating to the Angangueo Mountain in Mexico. These are common butterflies that use the poisonous milkweed plant as their host plant. The female butterfly lays an egg on the milkweed plant, which is about $1/8^{\text{th}}$ of an inch long. Out of the egg hatches a monarch larva in 3-5 days. These caterpillars then turn into pupas, from which then the butterfly hatches. During the caterpillar stage, the poisonous milkweed plant is consumed. The plant contains certain chemical compounds that create a cardiac poison, which affects most vertebrates. This poison is useful to the monarchs to avoid potential predators. These predators remember the color of the monarchs and stay away from them and their poison. (Monarch Butterfly Site, 1) — *NOT APPROPRIATE REF.*

The butterflies travel thousands of miles and it takes multiple generations for them to reach Mexico and then to travel back again. While trying to escape the cold winter in the north and returning when Mexico gets too warm, the butterflies are having more trouble every year due to the increase in global warming. The summers are getting hotter and the winters are getting cooler, which could force the butterflies to travel longer distances. The suitable habitats could be shifted northwards and the hot and dry temperatures could affect food availability, reproductive success and the adult butterfly survival rate. The objective of this essay is to find out to what extent global warming affects them and to raise awareness about the effects of global warming through a perspective not thought off on a regular basis. Global warming has many different effects on the world and the humans; however animals also suffer or benefit from global warming. Along with this issue comes other effects, such as deforestation and soil degradation, which are worthy to discuss in this essay and this also increases the importance of this topic. Therefore monarch butterflies will be used, to show how they suffer under global warming during their long migration. The changing patterns of the life of the monarch butterfly on the other hand affects the humans again, who have to deal with changes in tourism in Mexico. The monarchs have a significant financial impact on the surrounding towns, because very many people there depend on the tourism to make a dependable income and therefore the global warming also has economic and political changes in society, the geographical impacts of global warming. All these factors are looked at using the example of the monarch butterfly migration and the essay should hopefully raise awareness about global warming and its effects. *ref.*

The town of Angangueo is located in the east of the state of Michoacan and is about two hours away from Mexico City. This town had an economic peak at the end of the 19th century due to rich mines of silver that existed in the area. With time passing, the mines were not used anymore and interesting religious architecture was left that attracted tourists along with the Monarch butterflies surrounding the area.

(“Monarch Butterfly and Angangueo”, 1)

Figure 1: Angangueo from an aerial view



600-02045916 [RF] © www.visualphotos.com

"Overview of Town, Angangueo, Michoacan, Mexico [600-02045916] Stock Photos | Royalty Free | Royalty Free Photos VisualPhotos.com." *Stock Photos | Royalty Free | Royalty Free Photos VisualPhotos.com. Web. 12 Oct. 2011.* <http://www.visualphotos.com/image/2x4072889/overview_of_town_angangueo_michoacan_mexico>.

Investigation:

Decline in Monarchs:

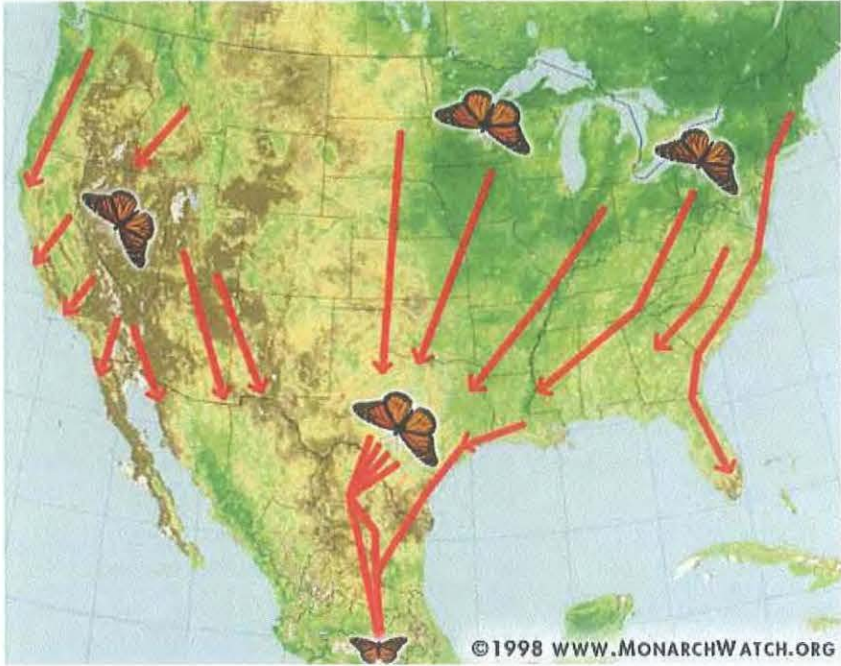
To write a detailed essay about this topic, specific research and investigating had to be done. To do this, certain information had to be collected. It is important to know about some biological information about the butterfly, as well as other factors that affect the monarch and at last, it is very important to find lots of information about global warming and its effects on the butterflies. To achieve this, research on decently reliable websites was done. It was especially attempted to get information from educational websites, such as websites from universities, which have primary data most of the time. In addition to this, emails were sent to different organizations such as universities, butterfly habitat preservation websites and even tour guide companies in the Angangueo area regarding the monarchs and their loss in numbers. Unfortunately no answer was received. With the information available, the investigation was split up into three parts; the decline in monarchs, global warming and its effects, and the impacts on society, as seen in the contents page.

Butterflies are small insects that are very fragile; however they still migrate and travel long distances. It is a phenomenon that they can do this migration. A map of the migration from the United States to Mexico and a map of Monarch sightings can be seen here:

C2

when? Which months?

Figure 2: Map of the direction of Monarch migrations in North America and Central America

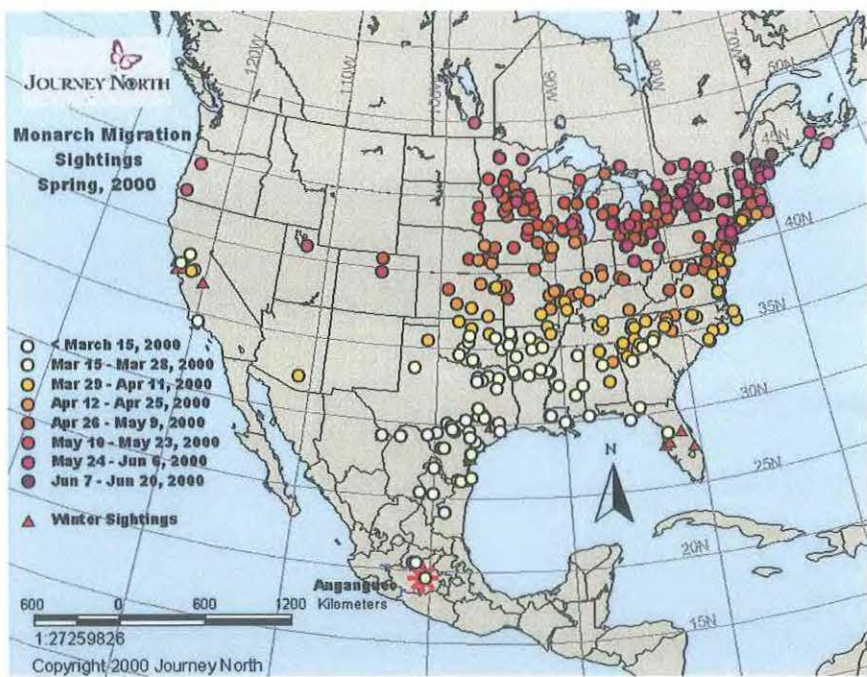


<http://www.monarchwatch.org/tagmig/fallmap.htm>

Seems like migration S

Explanation needed

Figure 3: Map of Monarch sightings in USA in spring, 2000



Seems like migration N. ?

http://www.learner.org/jnorth/maps/monarch_spring2011.html

Sound spatial elements

It is a trip through many ecosystems and climates in which the temperatures can be a threat to them, but also many other factors that are caused by global warming. Although the monarch butterfly is not an endangered species, the IUCN (International Union for Conservation of Nature) recognizes the monarch migration as an endangered phenomenon and this for some good reasons.

Before investigating climate change and its effect on the butterflies, one has to know the general factors causing a decline in the butterflies like breeding habitat loss, degradation, deforestation, forest fires, tourism and parasites:

Up to 70 % of monarchs feed on milkweed in agricultural areas. Almost all soybeans and a large amount of corn that is currently grown in the United States are genetically modified and this makes applications of glyphosate (a herbicide to kill weeds) on germinated weeds possible. Apart from the breeding habitat loss through degradation, there is also breeding habitat loss through urbanization or the suburbanization of agriculture. More land is utilized every year for housing and other industrial uses, instead of agriculture. This also decreases the growth rate of the monarch butterflies. Even on the sides of roads milkweeds are being mowed down and they are in general viewed as harmful in some areas, which cause the people to try to eradicate these weeds. This is a smaller factor that causes a decline in monarchs, since weeds can grow in many places at a fast pace, however it is still important to mention, since no species can live without a food source and this can be seen by many bird species that are having trouble finding food. (North American Conservation Plan, 23)

expt. nuclear
In some parts of the United States, ^{low level} ozone pollution is causing severe damage to some sorts of milkweed. This pollution is caused by the enhanced greenhouse effect, which is believed to cause global warming and is therefore important to know. The leaves turn visibly darker, however it is not known whether this ozone pollution affects the monarch caterpillars or not. ("Milkweed Check up", 1)

Monarchs are also experiencing habitat loss at their wintering habitat destinations, in this case around the mountains in Angangueo. There is a monarch butterfly reserve area; however monarchs are facing trouble outside of it.

A large issue is deforestation, which again links together with urbanization; the humans need the wood and the space to build more housing and rural to urban migrations are on the rise. A small bug called the bark beetle also eats away the forest giving monarchs less room and this beetle outbreak is an outcome of climate change. Many studies have established that an intact forest ecosystem is of very high importance for the monarch's survival in the winter. The forest provides unique conditions making the monarch able to survive in very low temperatures and they conserve energy until the next spring, when the next migration occurs. In the "Reserva de la Biosfera Mariposa Monarca" (the reserve for monarchs very close to Angangueo) has two zones of protection:

The migrations are not described

1. The **nuclear zone** is a zone where no cutting of trees is allowed.
2. The **buffer zone** is a zone where limited cutting is allowed.

("The Monarch Butterfly Sanctuary Foundation.", 1)

Figure 4: Picture of protection zones of monarchs in North and Central America

<http://www.fs.fed.us/wildflowers/pollinators/monarchbutterfly/conservation/index.shtml>

"Mariposa Monarcha Biosphere Reserve" is right next to Angangueo, also in the state of Michoacan



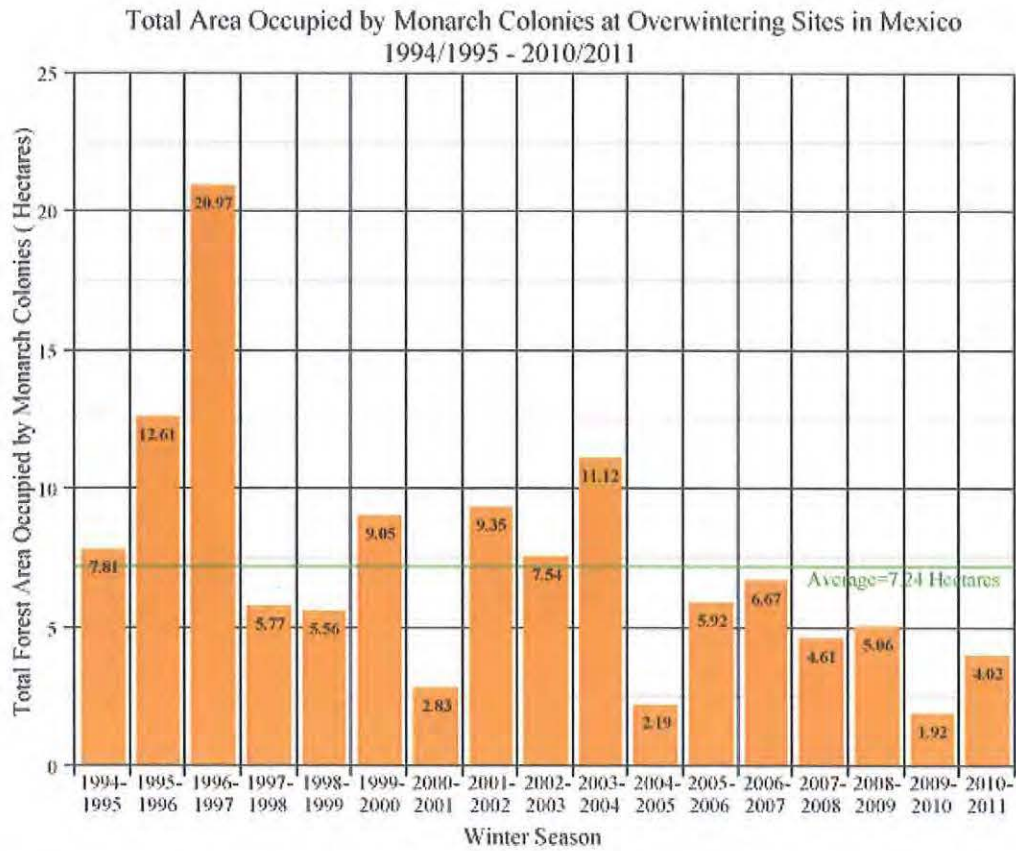
Similar to deforestation is the problem of forest fires. This either occurs naturally or the people want the ground to be full of nutrients, however in both cases it impacts the monarchs directly and destroys their habitats.

It is also believed that tourists are having an effect on the monarchs. There are between 100,000 – 150,000 visitors every year and the numbers are increasing every year and because the tourism and the guiding tours are poorly organized, the environment is most likely suffering from the large amount of people visiting. Lastly, monarchs are also dying because of parasites that feed of them, which are again smaller issues, however very important to be noted since all of these factors add up to a significant loss.

(North American Conservation Plan, 25)

All of these factors have affected the monarchs over the years and their decline can be shown in the following graph.

Figure 5:



(<http://monarchwatch.org/bring-back-the-monarchs/campaign/the-details>)

Figure 5 above shows the amount of hectares covered by the monarchs every year at their overwintering sites in Mexico. The data is not very consistent; there are many drops and rises over the years, but it is understandable as it is very hard to count the butterflies depending on which tactic is used and there are also many factors that influence the butterflies as listed earlier. It is very important to see that the average of 7.24 hectares of land covered was not reached from 2004 onwards. In the past 6 years, the average amount of hectares covered is 5.065 (calculated by adding all values from 2004 – 2005 onwards and dividing by 6) and this shows a significant difference to the overall average of 7.24 hectares. To get a better picture of the decline in monarchs however, a scatter graph would be more appropriate, to see a trend line.

Figure 6:

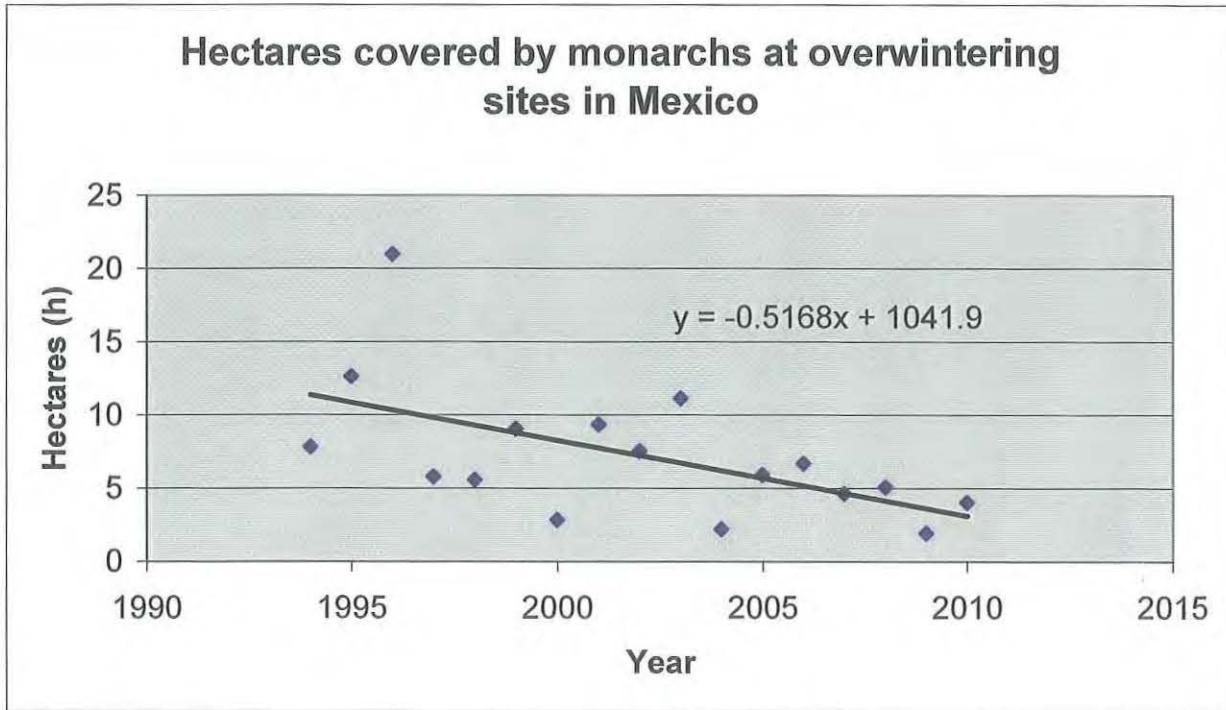


Figure 6 above shows the same data in a scatter graph with a line of best fit and its equation. Here it can be seen that the amount of hectares covered by the butterflies is steadily decreasing.

Figure 7: Table of Spearman coefficient of data from graph above

Year	Rank	Hectares covered by monarchs	Rank	d	d ²
1994	17	7.81	6	11	121
1995	16	12.61	2	14	196
1996	15	20.97	1	14	196
1997	14	5.77	10	4	16
1998	13	5.56	11	2	4
1999	12	9.05	5	7	49
2000	11	2.83	15	-4	16
2001	10	9.35	4	6	36
2002	9	7.54	7	2	4
2003	8	11.12	3	5	25
2004	7	2.19	16	-9	81

C4

Inappropriate statistical analysis. The years cannot be ranked as a ranked variable, as the hectares do not depend on the year but on other factors ¹⁰

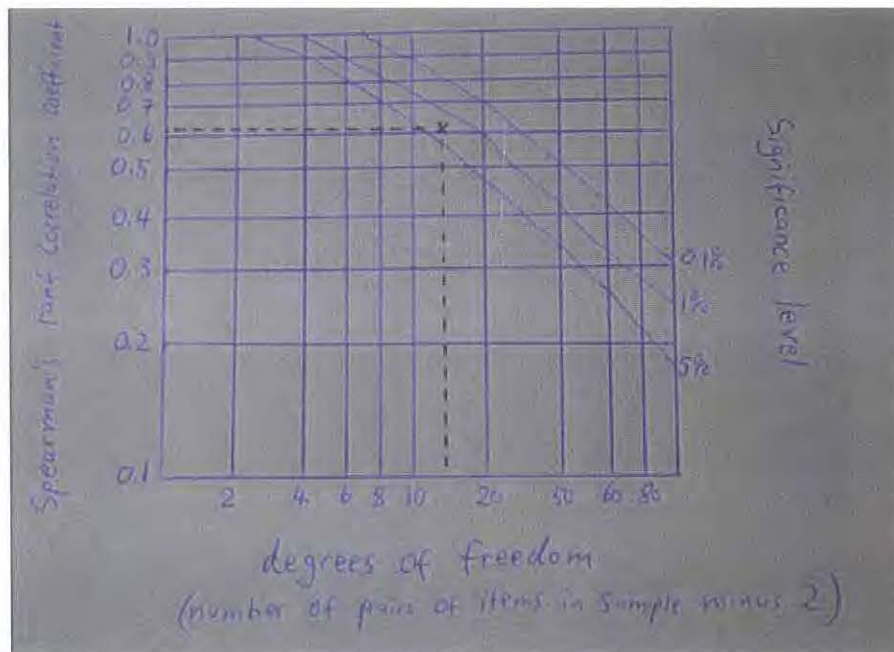
2005	6	5.92	9	-3	9
2006	5	6.67	8	-3	9
2007	4	4.61	13	-9	81
2008	3	5.06	12	-9	81
2009	2	1.92	17	-15	225
2010	1	4.02	14	-13	169
					1318

Hectaw should have been ranked against a dependent variable eg mean annual temp

!!

With this information, the spearman rank coefficient was able to be calculated, which is 0.6125 (the calculations can be found in the appendix) and this number does not look very good at a first look, since the correlation is strongest the closer it is to 1, however it can be further analyzed by testing its significance:

Figure 8: Sketch diagram of significance test of spearman coefficient rank



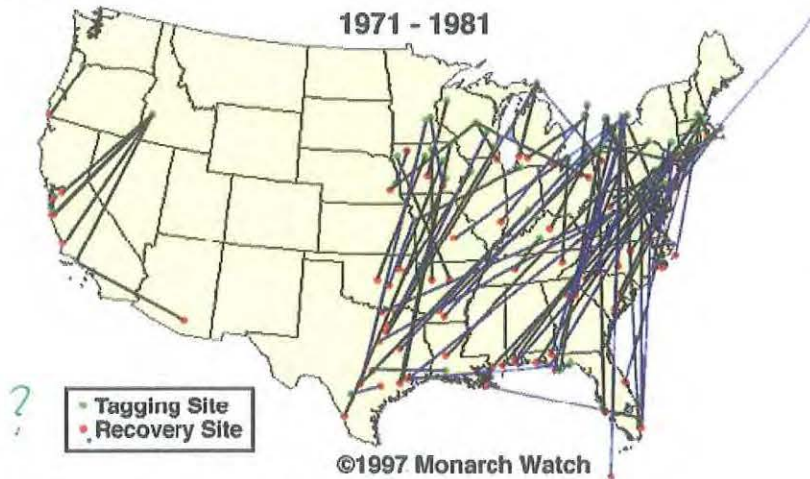
The little x represents the intersection between the degree of freedom 15 (17-2) and the spearman rank coefficient 0.6125 and it can be seen that is not in the rejection level, however it does have a significance level over 1% meaning there is a slight chance of coincidence. This is rather impressive since it is very difficult to capture and release the same monarchs and get results of this quality.

The decline in monarch butterflies can also be seen on maps of the United States where the monarchs were tagged and then recaptured. The lines on figure 9, 10 and 11 below show the migration of the butterflies and it can be clearly seen that these migrations have been decreasing from 1971 to 1994.

Although the migrations recorded on the maps below are only within the United States, it can be assumed that migrations to the Anganguero Mountain in Mexico are also decreasing. The tagging

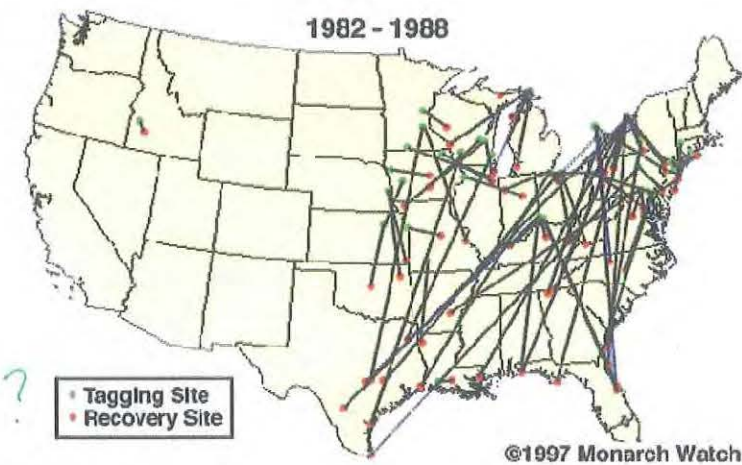
and recovering generally took place in the northeast and southeast of the United States, the only differences are the densities of the migration lines, which is clearly decreasing map after map.

Figure 9:



<http://www.monarchwatch.org/tagmig/urq1.htm>

Figure 10:



<http://www.monarchwatch.org/tagmig/urq1.htm>

Figure 11:



<http://www.monarchwatch.org/tagmig/urq1.htm>

Interesting data - correlate with warming ??

Global warming:

The largest mortality of monarchs is most likely going to be global warming. According to the predictions of entomologist Karen Oberhauser of the University of Minnesota, the monarchs wintering sites will become unsuitable in the next 50 years, due to wetter and colder weather in Mexico and the monarchs are also expected to have difficulties progressing in the east of the United States and Canada during warm temperatures. Monarch butterflies have a unique migratory cycle, which is very sensitive to climate change and according to Oberhauser "The whole cycle depends on climate, and the big question is whether monarchs can adapt." ("Climate Change May Endanger Monarch Butterflies.", 1) Many climate experts are predicting that the global temperature overall will increase by several degrees in the next century and this would create more ocean evaporation and this would lead to increased rainfall. ("Climate Change May Endanger Monarch Butterflies.", 1)

Oberhauser also predicts increased rainfall in central Mexico, where most of the butterflies stay over the winter. The forests in this area are so densely packed with butterflies that if climate change occurs it could have drastic effects for the following reasons:

Monarch butterflies can endure temperatures below zero, as long as their fragile wings remain dry. Therefore if it rains and then the temperatures drop at a fast pace, many butterflies will die out and this is exactly what happened in 2002; there was a rainstorm that soaked the monarchs and then the temperature dropped to negative five or six degrees Celsius which caused a huge mortality of monarchs. 80% of the wintering population was killed and if Oberhauser's predictions are correct, this may happen even more in the future.

The summers are also getting continuously warmer, which will most likely shift suitable habitat areas further north. The problem is that the monarchs then probably need another generation to reach their destination and it is unknown if they are able to do this.

("Flying Into Climate Change » Scienceline.", 1)

Oberhauser also predicts that the conditions the monarch butterflies need in order to survive the winter will not exist in the future where the over wintering sites currently are. (Near the mountains at Angangueo) According to Oberhauser, one of three things can happen to the monarchs if her predictions of the changing climate and the effects are correct:

1. In the next 50 years the climate change may cause the monarchs to go extinct.
2. The monarchs could find another over wintering site that will be suitable for survival in the future. (The atmosphere should be warm enough and/or dry enough so that the monarchs' wings do not become too wet and frozen.) This would also affect Mexico in other ways, since tourism is made up of many people that visit the monarchs and many tour organizations will disappear, depending on how far the monarchs fly away.

never explained

cause of

evidence of current changes!

why?

not everywhere

not explained

Lots of support here

3. Lastly, the monarchs could get used to the new conditions caused by global warming and somehow adapt, however nobody knows if they are able to do so and the chances are probably very low.

(Coale, Phil., 1)

Another influence that global warming has on the monarchs is that it has effects on the host plants of the butterflies; the milkweed plant. According to the University of Michigan, the rising carbon dioxide levels in the atmosphere may change the milkweed. Plant defenses change to rising carbon dioxide levels and other environmental changes, as well as the eating patterns of insects, including the monarchs. These changes are noteworthy, since the monarchs are very selective about the milkweed they choose and this rising carbon dioxide can change their behavior. In northern Michigan research was done on a milkweed population to see changes in growth patterns, reproduction patterns and the changes in production of the plant's defenses. (As already talked about above, milkweed is poisonous due to its chemical characteristics) The first observation that was made by the researchers was that all the plants grew larger. Their responses in their reproduction were similar, however the plant families responded differently to their production in chemical defenses. The milkweed's heart poisons called cardenolides differed from plant to plant. While some plant families increased their cardenolide production, most plants decreased it. Some decreased by as much as 50%, which does make a big difference to the insects that eat the milkweed. Monarchs and most other insects choose their host plants very carefully, taking the toxic compounds in the plant into consideration. The milkweed also grew thicker leaves in response to the elevated carbon dioxide levels, however it is not known whether these changes will help the monarchs, or make their lives even more difficult.

("Global Warming May Reroute Evolution, Milkweed Research Finds.", 1)

General effects of global warming and its effects on the monarchs:

Global warming has multiple visible effects on the planet and therefore also on the monarch butterflies.

1. An effect of global warming is the **spread of disease**. Insects that carry diseases migrate north as the planet warms and these diseases could be transferred to the monarchs. Parasites could also migrate north to warmer temperatures where the monarchs are and could therefore be very harmful to them. *evidence*
2. Another huge change that came with global warming is the increase in **storms** and their intensity. Hurricanes have not only been destroying homes and infrastructure in many cities, but these hurricanes also kill the butterflies. They destroy the milkweed the monarchs use to continue their generations. In the last 30 years, the destructive power of the storms has increased about 50% and this was linked with the warming oceans caused

evidence ✓
evidence |
does not
support this

by global warming. Strong winds in general make a migration of such a long distance a lot harder. (Lion, A., 2)

3. The **flooding** that occurs through global warming also has an effect on the monarch butterflies. Just like the melting of the ice caps raises the sea levels, the warming of the sea itself creates thermal expansion which raises sea levels even higher and this causes more flooding. These floods can destroy the butterflies over wintering habitats as well as milkweed itself where the monarchs leave their eggs. The flooding might also become larger because the warmer air holds more water vapor, which increases rainfall.
4. As already mentioned earlier, increasing temperatures due to global warming lead to more **forest fires** that burn the monarchs, their habitats and the milkweed they use to lay their eggs on.
5. Another issue that results from the enhanced greenhouse effect is **smog**. These dangerous clouds are created through the fumes of vehicles, industrial pollution and ground level **ozone** pollution, which are a threat to the monarchs just as much as to the people. This smog could affect the milkweed but also the butterflies directly and especially at their over wintering sites in Mexico there could be smog problems in the future, because around the Angangueo mountain there are very dense urban areas that pollute.
6. With global warming also come **cold waves**, which are large drops in temperature over a 24 hour time span. This would be harmful to the milkweed and the flowers the monarchs use to feed of, but even more to the monarchs themselves, especially in the combination with rainfall.

But the migration routes are overlaid

evidence

evidence

Impacts on society:

Although monarch butterflies are small creatures, they still affect our society to a certain extent. Politically, the government is not necessarily forced to change anything due to the monarchs, but laws and regulations are still made in order for the monarchs to survive. The monarch reserve was set up and the regulations of protection zones were introduced. (Nuclear and buffer zones where taken into law, where no cutting or limited cutting is allowed as mentioned earlier.)

Another issue the government has to deal with is the drug war violence. In the state of Michoacan, where the butterflies stay over winter every year, drug violence is occurring and the visitors are being scared away. At the end of last year (2010), all the major roads in the state capital were shut down due to shootings between the police and criminals. The local dominant gang "La Familia" is also known for decapitating its rivals, which scares away tourists even more, although the drug violence in general happens far away from the monarchs. ("Mexico's Drug War Keeps Tourists From Monarchs", 1)

The government therefore has to fight against the violence in order to bring back the tourists.

Not related to butterfly or global warming

These monarchs also bring with them economic importance, because their migration is a phenomenon that attracts many tourists. The villages around the butterfly reserve basically live off the tourists that visit. Some locals work as tour guides, a job that would completely disappear without the monarchs. Others own small restaurants or food stands and small children sell souvenirs or attempt to sing on the streets for money. These ways to make money are dependant on tourism and without the monarchs; people don't have many reasons to come to a rather poor area such as Anganguero. If Oberhauser's predictions are correct, these people will have to find another way to make money in 50 years and keep their village alive. There are also many organizations in the United States that raise awareness about the monarchs and they raise money to help save the monarchs in the future.

Conclusion:

Monarch butterflies are significant insects that travel thousands of miles with multiple generations to Mexico and back to North America. Like many other animals, they are threatened by global warming, an issue the humans are making even worse every day. Global warming has many effects on the planet and many people know about these effects, but it also effects the monarchs; a specie not too many people think about when it comes to global warming and its effects and that is the point of this essay; to raise awareness of further damage of global warming that is usually not thought off.

Although perfect counting methods cannot be performed on the monarchs, it is becoming increasingly obvious that they are on the decline. If Oberhauser's predictions are correct, there will be increased rainfall with cold waves in Mexico, wiping out the monarchs in 50 years. Currently there are organizations fighting for the survival of the monarchs and therefore also the villages around the monarch reserve. It can be fought for that the monarchs can keep their overwintering sites and it could even be organized that there is plenty of milkweed for the caterpillars; however humans do not have the power to control the climate. The monarchs would need another place to go spend the winter and maybe and summer, otherwise the monarchs will just have to adapt and the humans have to hope that they will survive. What exactly will happen to Anganguero and other surrounding towns when the monarchs die out and what other drastic effects does global warming have on this world? These are questions that cannot be perfectly answered currently and all organisms just have to adapt to climate change.

How the Monarchs migrate over generations is never explained, the routes are not described. A promising topic with viable spatial elements, but the analysis is incorrect (specimens) and the essay is essentially descriptive with findings based on supposition rather than evidence. Potentially an excellent area of investigation with access to changing climate data (ignored)

Appendix:

Calculations made for Spearman coefficient rank:

$$R = 1 - \frac{6 \times 1318}{4913 - 17}$$

$$R = - 0.6152$$

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