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The Struggle Begins

Located in Norway, the Svalbard Archipelago is home to unique arctic wildlife. Unfortunately, this area does not escape from the devastating impact of global warming. Recently, polar caps, sea ice and permafrost have been melting and the habitat of vulnerable species including the polar bear have been threatened. Given the worldwide concern, how can satellite imagery help us evidence this impact of global warming on the habitat of the polar bears residing in the Norwegian Svalbard Archipelago during the last 14 years (2001-2015)?

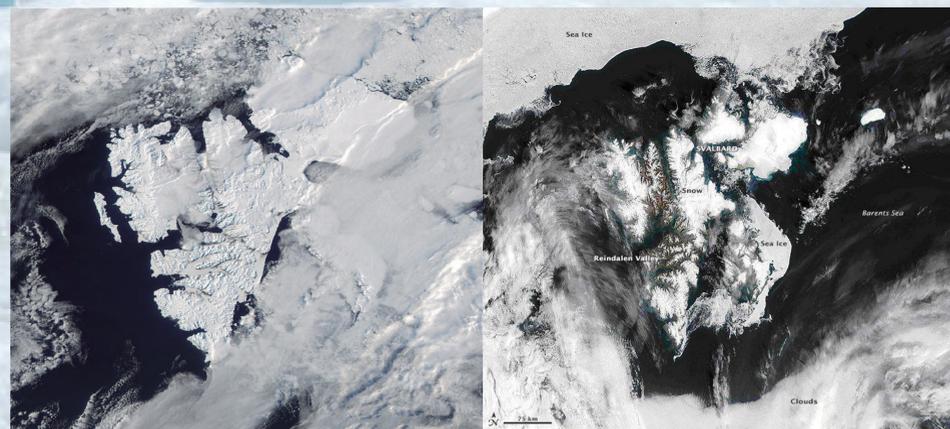


Fig 1. Svalbard Archipelago in 2001 (left) and in 2015 (right)

These images captured by MODIS [1][2] evidence the shocking reduction in sea ice dimensions as a result of climate change within the 14 year interval.

The Unexplored Svalbard

The Svalbard Archipelago is a cold and arctic desert, it's almost 60% glacier-covered, and 10%, at most, is covered with vegetation [5]. As the Earth's temperatures have risen by approximately 0.6° over the last 50 years [6], the territory has experienced a significant decrease on the percentage of firm ice caps. Ergo, much of Svalbard's flora and fauna has been affected, particularly the polar bear. Although firm ice caps in the area provide more and better resources for the polar bear to hunt its preferred prey, the ringed seal, the significant regression of these ice caps has forced the species into adverse conditions, resulting in the decline of the polar bear population.

Imminent Threat Towards Polar Bears

| Effect | Impact upon Polar Bear Habitat |
|---|---|
| Altered ice formation periods: Sea ice melts earlier during spring and forms later in autumn | <ul style="list-style-type: none"> Longer periods of loose ice rather than firm ice to hunt. Therefore, polar bears have been forced to swim longer distances in order to reach their prey, exerting large quantities of energy. Polar bears have less time on firm ice to rest in order to recover energy as well as restoring their body fat to be able to leave again to hunt. |
| Reduction of polar ice cap dimensions | <ul style="list-style-type: none"> The larger gap of open water between the ice and land also contributes to rougher wave conditions, making the bears swim from shore to sea ice more hazardous. Modifications in terrain stability have forced the mothers to be in constant movement, altering their reproductive cycle and gestation pattern, resulting in a direct impact on cubs' welfare. Altered migratory patterns: Polar bears' net displacement has drifted northwards during summer and southwards during winter. Polar bears have adapted to a nomadic lifestyle due to territory instability. |
| Lack of availability of feeding resources | <ul style="list-style-type: none"> The scarcity of food has resulted in cannibalistic behavior. Although it has long been known polar bears will kill for dominance or kill cubs so they can breed with the female, outright predation for food was previously unobserved by biologists. |

Table 1. Impacts of global warming effects upon the polar bear's habitat

Given the detrimental repercussions on the polar bear population, several studies have been done regarding climate change in the region –most of these executed by the Norwegian Polar Institute. The innovative component of this investigation, however, is the use of satellite imagery to complement the analysis, which allows for a better understanding of how global warming is really affecting the polar bear and further reaffirms the importance of preserving this vulnerable keystone species.

Our Last Chance

The imminent impact climate change is having on the vulnerable Arctic ecosystem, and the species that depend on it, is clearer than ever. It is in our hands to minimize the effects of global warming, and avoid critical damage on vulnerable species', such as polar bears, which inhabit the ecosystem. However, the question remains: is the impact caused by global warming on the Arctic reversible, or do we have to focus our efforts on the preservation of what is left, rather than restoring what has already been lost?

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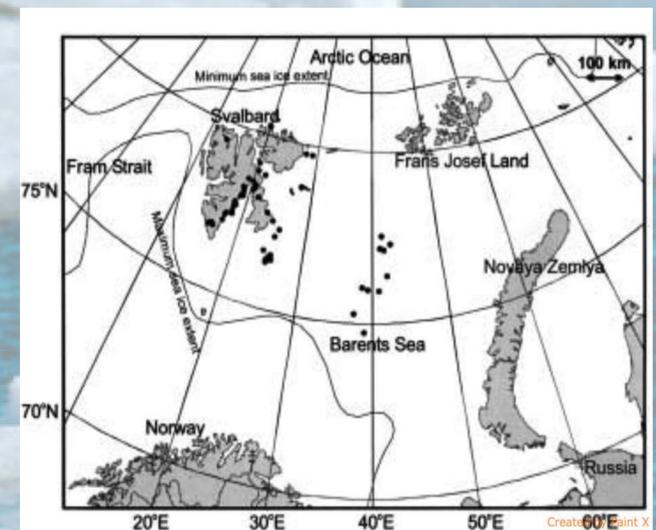


Fig 2. Archipelago's sea extent. Max: April and Min: September. Location of 86 satellite tracked female polar bears.

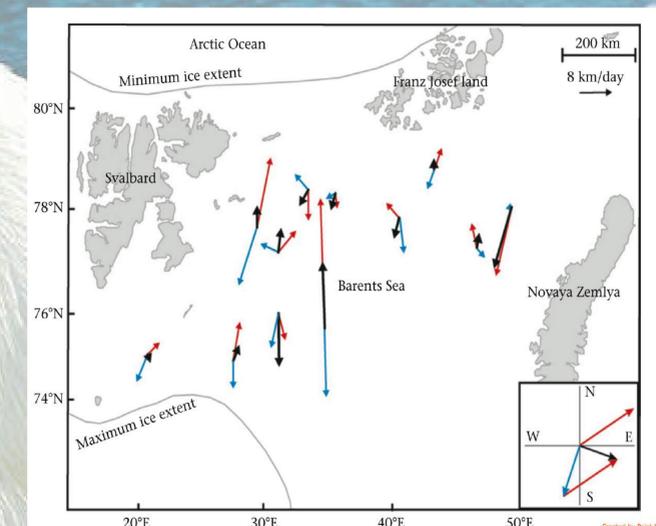


Fig 3. Study map of female polar bears' net displacement (black), corresponding ice drift (blue) and movement (red) in the Barents Sea during March.