

## **Fundamental vs realized niche assignment part 1 and 2**

Bio\*1500  
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Before diving into the concepts of fundamental and realized niche, let us first briefly go over the history and development of the niche theory. In 1917 Joseph Grinnel first used niche but it was more so to describe a species habitat and the impact of the habitat on the species itself. Grinnel rarely mentioned other impacts of factors on a species niche such as food availability, or inter-species interactions. Over the year's important theories would build upon Grinnel's and give us the modern-day niche theory that we are familiar with today. Charles Elton and his work with organism's food habits, the Gause theory which helped tie together niche and species competition, and work by Huthinson in the 1950s which involved a multitude of environmental variables. These variables helped give an idea of the ranges in environmental conditions organisms could survive in (Vandermeer, John H. 1972). Huthinson would then go on to coin the terms fundamental and realized niche which will encompass most of this paper.

Now niche can be defined from Oxford dictionary as "the role taken by a type of organism within its community". However, this seems to be a much too watered down definition for my liking. According to dictionary.com a niche can be defined as "the role an animal or plant plays in the environment, the status of an organism within its environment which affects its survival". This definition is better as it talks about its role affecting the organism's survivability within its environment. Survivability based on what the organism eats, what eats the organism, where and when the organism sleeps, and so on. One way to picture it is as the organism's job and unique interactions with other species in the ecosystem. For example, the dung beetle of South Africa has developed quite a narrow niche, instead of hunting for smaller insects for food like many other insects, the beetle uses animal droppings as a food source within its environment for survival and in turn is a food source for larger predators. Now that niche has been briefly

defined let us talk about two variations of the term, the organisms fundamental niche and the organisms realized niche.

An organism's fundamental niche is essentially the range a species could live given that its only interactions were with environmental conditions such as temperature, precipitation, and climate to name a few. All biotic factors have been removed to give an optimal condition for the organism to grow and thrive in. I like to think of it as an organism winning the ecological lottery that allows them to grow, reproduce, and survive in an extremely favourable environment absent of all predation and competition. This organism no longer needs to worry about being eaten and can divert that energy to other areas such as growth or reproducing more offspring. One example that helped drive home this concept involved a fish and an aquarium (the environment it lived in), Let us say that our fish is named Tom and lived out his early life in a pet store with other species of fish. In Toms early life times would have been difficult as competition for food and space was fierce. Tom is a relatively slow fish so often all the fish food would be eaten by the other fish so Tom had to resort to eating algae which causes him to grow at a stunted rate (realized niche). However, good news Tom has been adopted by a loving family and has an aquarium all to himself which allows him to live a pretty good life. The water is the perfect temperature for his growth, ph level within his range, a seeming endless food supply magically drop from the heavens. All other influencing environmental factors are within Toms habitable range and all negative factors brought on by other species which he had to deal with earlier have been removed from the equation. This optimal lifestyle is known as Toms fundamental niche. Now that we have talked about Toms fundamental niche what about it in regards to humans?

First off the human fundamental niche is limited by our biological constraints. The adult human body tries to regulate a core temperature around 37 degrees. Anything below 32 degrees or above 39 degrees can lead to death. This puts in perspective how fragile the human body can be in a harsh environment like Antarctica or another extreme the Sahara Desert.

Again, to clarify a fundamental niche is essentially a perfect world for an organism to survive in without any competition. Therefore, in respect to humans this means a world that is absent of many present-day factors such as harsh weather, earthquakes, and tsunamis. The only deaths would be due to old age as getting sick or injured would not be a factor because viruses, disease, and famine would be non-existent. Humans would not have to worry about going hungry as food would be free and in ample supply for everyone. People would not have to work, or go to school because everything that humans need would be readily available. Resources to build shelters would be free and easily accessible for everyone. Essentially humans fundamental niche is a world absent of competition, sickness, injury, work, or danger. However, is this make-believe world all good? To my knowledge humans need to have a sense of purpose in life and work helps tackle this dilemma. All the dangers that are present in the realized niche but absent in the fundamental niche have influenced and led to our continued development as a species. For instance, increased competition, or lack of game to hunt may have influenced humans to focus more on agricultural methods of growing food. Maybe, natural disasters in various parts of the world have helped us come together and grow as a species by helping those in need. The horrors of war have taught us invaluable lessons, and led to increased technological advancement. The list goes on, I feel that if humans had lived in its fundamental niche for the duration of our time on earth we would be living in some timeframe centuries in the past because there would be no

need to innovate, or take risks as all basics would be provided in a fundamental niche. Enough of this rant. Let us look more in depth of the other component of niche.

Now the other aspect that must be discussed is the species realized niche. A realized niche takes everything into consideration that a fundamental niche fails to include (no more perfect world for Tom). It is essentially a reflection of the reality an organism faces, possibly from fierce competition which in turn limits food supply or maybe a harsher climate. These factors put pressure on the fundamental niche and cause it too shrink down until it reflects the actual present day which is known as the realized niche. The Oxford dictionary defines realized niche as “the niche a viable population occupies in the presence of competitors”. You can think of a square (fundamental niche) and within that square is a smaller circle (realized niche) (Jacobs, Shoshanah. et al, 2015). Every wild organism whether it be a salmon or an elephant is surviving within its realized niche and not its fundamental niche. To better explain this concept lets look at two fictitious species of birds, green and red birds. The green birds can nest in the bottom, middle or the top of the trees but the red birds can only nest at the top of the tree because their red colour attracts predators who can reach the bottom and middle of the tree. This so far represent the fundamental niche of the green birds. Let us suppose due to a shortage of trees these two species of birds are forced to nest together. What we would see is the realized niche of both species, the green birds would nest in the bottom and middle but no longer the top of the tree as that is where the red birds would nest. The two species would co-exist to avoid competition. Essentially the realized niche is the space that the species ends up occupying while the fundamental niche is the full potential range that the species can occupy.

Since the dawn of man biotic factors have limited our realized niche. However as various technologies, from the discovery of fire to warmer clothing the realized niche has gradually increased. By looking at the movement of man over the past 200,000 years it is quite easy to see the expansion of our fundamental niche. The movement out of Africa and into most of Europe and into Asia occurred over 150,000 – 30,000 years ago due to changing climate, and improvements in technology (Naito, Yuichi I et al, 2016). These years fall into the 300,000 – 30,000 years ago Middle Paleolithic age where technologies like the discovery of fire, advances in weapons such as spear making, improvements in clothing and even the discovery of food preservation all of which allowed humans to live in colder climates across. Over the next 30,000 years passing through the upper Paleolithic age, bronze age, and industrial age to name a few, humans became increasingly modern with more complex technologies until we arrive at our present date, and present realized niche. but what is the current human realized niche? I believe that there is no single definition of the human realized niche like the human fundamental niche but a multitude of varying realized niches that humans occupy.

Getting more specific we can look at my realized niche. Biologically I can live on most of the land masses on earth. I could live in Africa, Asia, or even Russia. However, part of my realized niche is that I live in Ontario, Canada. A geographical location that for 8 months of the year tend to have a colder climate. However, I as well as many other humans have used various technologies to deal with these harsher climates. During the winter, I survive with minimal effort thanks to the gas heating that regulates the temperature in my brick bungalow, and when I decide to go outside I put on my heavy coat, toque, gloves, and boots, all of which are factors part of my realized niche. Competition is very present in my life, less so against other species due to technological intervention and domestication and more so because of what is known as

intraspecific competition. Let me explain, I do not compete directly against other species for food, or shelter. If I am hungry I open the fridge and grab some food which was purchased from the grocery store. For some humans, interspecies competition is a big part of their realized niche which will be touched in later parts of the paper. However, the form of competition I face daily is known as intraspecific competition which is defined as competition among the same species (Jacobs, Shoshanah. et al, 2015). I competed against thousands of applicants to get into university, right now as I am writing this essay I am competing among my peers to get the best mark. This mark will hopefully allow me to get the credit, which will put me closer to getting my degree. Once I have my degree I must compete against thousands of graduating students for a job in my field. This job will provide me with money that I will use everyday to combat factors in my realized niche. Whenever I become sick, medicine will need to be bought to make me better. When my phycological needs kick in (hunger, thirst) I go to the grocery store to buy food to survive and so on until I die of old age or in a horrible accident made possible by my realized niche. For most people living in developed countries this is the reality faced daily, however when you look at developing countries such as parts of Africa or Asia the realized niche is centred more so around survival.

## **Part 2**

For this part of the assignment three groups of people and their associated niches will be studied. The first group that will be looked at is from the distant past, in fact they roamed the earth over 40,000 years ago (Vergano Dan, 2015). These people were known as the Neanderthals. Now the Neanderthals lived during the ice age throughout parts of Europe and Asia and had to deal with much harsher abiotic and biotic factors. As you can imagine my realized niche would have been completely alien to what the Neanderthals experienced. Some of the abiotic factors would have been a harsh cold environment and to deal with this they had shorter and stockier bodies which allowed them to retain heat. The Neanderthals lived almost exclusively in limestone cave dwellings (Vergano Dan, 2015). Until a recent discovery of fecal matter in 2014 it was believed that Neanderthals almost exclusively ate meat. However, with the new findings it seems that their diet consisted 70% meat and 30% vegetables/nuts, which suggests they were mainly a hunting and gathering society (Naito, Yuichi I et al, 2016). Moving on to more biotic factors, Neanderthals hunted Mammoths, reindeer and sometimes even rhinoceros in pack like ambush style attacks with stone spears. Neanderthals were not the only organism hunting these animals, competing predators like bears and big cats were quite problematic and influenced when Neanderthals hunted. In summary, the Neanderthals realized niche was formed through abiotic factors like climate, geographical location, cave shelters and through biotic factors such as diet, and competition among larger predators.

The second group of people I will talk about are from a similarly cold climate but a much more modern time. The Inuit have a nomadic way of life throughout Northern Canada and Greenland, moving from place to place building temporary shelters out of snow which are known as igloos and tents made from animal skin in the summer (Harold, Gerald 2004). Like the Neanderthals, Inuits have shorter and rounder bodies best able to retain heat. To get around the Inuits employed numerous forms of transportation like seal skin kayaks, small boats, and most importantly dog sleds which is an integral part of Inuit culture (Harold, Gerald 2004). The sled is usually made from wood or animal bones from whales or other large animals, clothing is made from animal skin or fur. Inuits pride themselves on using every part of animals that they kill, nothing goes to waste, partly because resources of any kind are scarce. The main food source of the Inuit consists of fatty meat from sea mammals like seals, and plants such as seaweed and types of grasses. This makes the Inuit a hunting and fishing society with very strong gender roles. Men are expected to hunt and provide for their family while woman stayed at the camp looking after children and cooking tasks (Harold, Gerald 2004). To summarize, harsh ecological factors have played very strong roles in the formation of the Inuit's niche. The climate has affected the body type and clothing of the Inuit people, provided ice and snow for building materials and transportation methods, provided the tools necessary to hunt and fish, and all of this together created a unique niche unlike any other.

The third and final group that will be covered in this report reside in Africa, a much warmer climate than the other two groups previously talked about. This section will examine the Southern African tribe known as the Zulus. The Zulus rose to power in the late 18<sup>th</sup> century from hundreds of smaller clans. The climate falls into the sub Saharan region, which means that it is a

dry and arid climate which reflects the clothing worn by the Zulus. Most of the clothing was made from cow tails, and cow skin worn on the legs, arms and parts of the chest and waist (Kapff, Uli Von, 1997). Cows are an intricate part of the Zulus culture and not only act as a food source but also as currency. Zulus diet consist mostly of vegetables. Maize, cabbage, and pumpkin are the most consumed while meat is much harder to come by (Kapff, Uli Von. 1997). The Zulu men for the most part are slender and medium in height with light builds. Zulus build small huts from mud, clay, and sticks and like their permanent structures the community tends to stay in one location. Strong gender roles strike up the heart of Zulu culture. Boys are given multiple names during their life and are responsible for looking after the family's herd which is the livelihood of most Zulu families. Girls are expected to partake in the daily chores and cooking tasks until they reach child bearing age (Kapff, Uli Von 1997). These abiotic and biotic factors come together to reduce the fundamental niche and form the ecological realized niche of the Zulus.

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