

# Foraging Wild Resources: Evolving Goals of an Ubiquitous Human Behavior

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## Abstract

Although human foraging behavior, i.e., the method used to get food procurement from the wild, is the economic criterion usually used in the academic literature in order to define hunter-gatherer societies, it is restricted neither to these societies nor to this goal. It consists of the extraction of natural resources by means of various techniques, such as hunting, fishing and gathering. It is applied to a broad range of wild resources – aquatic and terrestrial, plants, animals and minerals – even though in some cases it could be limited only to some of these resources such as the non-timber forest products (NTFPs). The aim of this paper is to demonstrate that while foraging is an ubiquitous human behavior, its goals are evolving with the passage of time. More precisely these goals that exist today have been present in some form in the past, only their importance and emphasis has changed over time and with the historical, sociological and ecological contexts. While subsistence seems naturally the most obvious motivation of human foraging behavior, the latter also occurs in various contexts such as in mixed economies. Moreover, other goals – different from the biological one – also exist. Indeed, foraging can be a mean to obtain a – primary or secondary – source of income provided through trade of harvested wild products. Socio-cultural goals may also motivate human foraging behavior. They are related to culture and heritage, recreational values, or to environmental conservation and sustainability, the latter being exemplified for instance by the recent movement of urban foragers.

**Keywords:** Foraging; Hunter-gatherers; Mixed economies; Forager-trader; Urban forage; Identity politics; NTFPs

## Introduction

Foraging, i.e., the search for wild sources of food, is a ubiquitous behavior among animals. It affects an animal's fitness because it plays an important role in an animal's ability to survive and reproduce. Thus, understanding the rules that shape the foraging behavior of animals has been a central focus of behavioral analysis for more than four decades [1]. While animal behavior and foraging are inseparable, the links between human behavior and foraging seem not to be obvious in the academic literature. Such links are either neglected – because agriculture provides most of our food since the Neolithic period or mainly restricted to hunter-gatherers societies.

It is the aim of this paper to provide a study of human foraging behavior. For that purpose, we have to answer to three questions. Who (among humans) is foraging? How humans are doing so and what do they forage? And, when people are foraging, what are their goals? In a behavioral perspective, the latter question is the most important. Indeed, when it is analyzed in an historical perspective – from the Palaeolithic period to nowadays – human foraging is an ubiquitous behavior but it is associated with changing or evolving goals. In doing so, we work to extract human foraging behavior from its traditional role as place marker (as an 'early' or 'simple' stage) within a presumed cultural evolutionary sequence.

## How to define 'foraging'?

Before we turn to the study of human foraging behavior, we have first to provide a – as much as possible - clear definition of 'foraging'. Even though foraging is not necessarily associated with hunter-gatherer (HG) societies, it is useful to recall first the close and historical link between HG and foraging.

Until 12,000 years ago – i.e., before the Neolithic revolution - virtually all humanity lived as hunters and gatherers. Because agriculture was not yet invented, these pre-Neolithic HG were "pure

foragers", i.e., they got their subsistence by harvesting resources from the wild. In the sequel, mostly HG societies have been defined by their mode of subsistence. Of course, several variations of this definition exist in the literature [2] but without loss of generality, we can consider the following one provided by Panter-Brick, Layton and Rowley-Conwy [3]: "Hunter-gatherers rely upon a mode of subsistence characterized by the absence of direct human control over the reproduction of exploited species, and little or no control over other aspects of population ecology such as the behaviour and distribution of food resources".

The basis of Panter-Brick et al.'s [3] definition of foraging is the mode of subsistence because their purpose was to study HG societies. However and even though such definition is clear, using it does not avoid problems, particularly (given our purpose) in the grey area between wild and cultivated resources. For instance, while it is commonly agreed that Australian Aborigines were pure HG, and hence true foragers, they nevertheless "husbanded" nature. Indeed, they developed a selective fire stick culture which helped them with their harvest of wild foods and favored some species which they valued. This example shows that determining whether a society practices "agriculture" or not raises some problems.

## Foraging and Farming, Two Polar Cases?

In fact, the relationship between humans and the nature involves – theoretically - two polar cases: a behavior in which human acts as a prey against the nature (namely foraging) and on the other hand, the

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**Received:** February 02, 2016; **Accepted:** March 01, 2016; **Published:** March 04, 2016

**Citation:** Svizzero S (2016) Foraging Wild Resources: Evolving Goals of an Ubiquitous Human Behavior. *Anthropol* 4: 161. doi:[10.4172/2332-0915.1000161](https://doi.org/10.4172/2332-0915.1000161)

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husbanding by domestication of plants and animals. Between these 'two polar cases', there exists a wide range of relationships, including taming [4]. Taming encompasses commensalism/mutualism at a low-level of management, whereas directed control over reproduction is associated with domestication. Taming differs from domestication. By contrast with the latter, it does not imply morphological or biological modification of species. Bellwood [5] defines domestic crops as plants that show recognizable indications of morphological change from the wild phenotype, attributable to human interference in the genotype through cultivation». For plant production, agriculture involves several distinct tasks: preparing the land and planting; certain nurturing activities such as fertilizing, irrigating, weeding and warding off predators; and, finally, harvesting and the selection of seeds to store for next year. One may thus say that agriculture involves both modifying the environment (i.e., cultivation) and manipulating the genetic material of plants or animals (i.e., domestication) to increase the labor productivity of obtaining food.

To decide where the line should be drawn between agriculture and related subsistence activities, some distinctions need to be made. Although plants as well as animals were only domesticated in the Neolithic period, they were tamed by hunter-gatherers – i.e., by pure foragers - before that period. For plants, a wide range of technologies may be considered as 'taming' (fire stick culture, soil aeration, watering fields, semi-sowing or voluntary incomplete harvest of seeds...). These activities are proto-plant-production or proto-agriculture since they place a greater emphasis on managing the environment for plant production, rather than on nurturing the crops or deliberate manipulation of the genetic materials of the plants [6].

Therefore, and even though it is not ideal<sup>1</sup>, by using Panter-Brick et al.'s [3] definition a lot of confusion can be eliminated because it highlights the key difference between hunter-gatherers and agriculturalists, and thus between foraging and farming. Indeed, agricultural societies are characterized by the control of the production and the productive inputs to the food supply.

### Some Reasons of Human Foraging Behavior Studies

There are at least four reasons, which are respectively biological, anthropological, ecological and economical, which support the view that human foraging behavior is still important to be studied.

### Is human foraging eclipsed by the ultra-sociality of the Agrarian society?

First, most of the time humans are considered as one of a handful of species that became ultrasocial<sup>2</sup>, a broad term including humans as well as other species that have achieved higher level of social organization. Like several social insect societies (ants, termites, bark beetles...) that made the leap to agriculture, from the Neolithic revolution which has occurred around 10.000 BC, human society began to function like a single organism dedicated to the purpose of producing an economic surplus [7,8]. In other words, human foraging behavior seems unimportant because, in addition to major ultrasocial traits

<sup>1</sup>Because, for instance, such definition does not say much about the difference between conscious and unconscious selection, a distinction Darwin was the first to make explicitly.

<sup>2</sup>According to Campbell [9], there is a parallel between some insects (e.g. ants, bees) and human societies because both of them share a common trait, namely ultrasociality: "Ultrasociality refers to the most social of animal organizations, with full time division of labor, specialists who gather no food but are fed by others, effective sharing of information about sources of food and danger, self-sacrificial effort in collective defense. This level has been achieved by ants, termites and humans in several scattered archaic city-states" [10].

such as having a complex division of labor, city-states, humans also have – since the Neolithic revolution - an almost exclusive dependence on agriculture for subsistence. Such point of view must however be qualified.

Indeed, even though some insect societies are ultrasocial, they are not "real agriculturalists". Indeed, in any human agricultural production process, the output is a plant species (e.g. corn) produced by means of inputs including the same plant species (e.g. seeds of corns). When some insects are "producing" their food, the production process is different. Indeed they<sup>3</sup> use some inputs (e.g. leaves) which are different from the output they get (e.g. mushrooms). Moreover, the inputs used are harvested by these insects. In fact the latter do not produce their food; they organize a biological process which transforms some foraged inputs in an output they consume as food. Thus, even ultrasocial insects are foraging, i.e., foraging is really ubiquitous among (human and non-human) animals. Furthermore the dichotomy between foraging and farming is often dubious, as exemplified in mixed economies [11] and more generally in many contemporary agricultural systems [12].

### Is foraging a feature restricted to hunter-gatherers societies?

Second, the rise of farming and animal husbandry is clearly documented by archeological studies and records which demonstrate that in a period which spans from 10,000 to 5,000 BCE agropastoralism appeared independently in at least seven different locations worldwide: the Levant, North China, Mesoamerica, New Guinea, the Andes, North Africa and India. From any of these centers, agropastoralism has spread all over the world and has had major consequences, such as the increase of the human population level, increased social and economic inequalities, the rise of cities, states and civilizations [13].

In other words, it is true that, from the Neolithic period<sup>4</sup>, agropastoralism has been the cornerstone of humankind evolution, for economic, social, cultural as well as ecological concerns. However, the previous claim does not necessarily mean that the alternative mode through which humans are able to get their food – namely foraging – has disappeared with the advent of agriculture. In fact, such confusion is possible because most of the academic literature about human foraging behavior is associated with hunter-gatherer societies. For instance, Renfrew and Bahn [14] define hunter-gatherers as "a collective term for the members of small-scale mobile or semi-sedentary societies, whose subsistence is mainly focused on hunting game and gathering wild plants and fruits; organizational structure is based on bands with strong kinship ties." In other words, foraging – which is a mode of "production" of food resources – is closely associated with the life way of hunter-gatherers. This is so because until the Neolithic period, i.e., for 99% of their presence on earth, humans were exclusively hunter-gatherers, i.e., they were relying their subsistence on foraging activities such as hunting, gathering, fishing, collecting. Therefore, human foraging behavior is studied as a major feature of hunter-gatherer societies.

Such studies, which mainly belong to the anthropological literature, focus on three main questions. First, how (and what) humans are foraging? Such question is similar to the one concerning animals foraging and is studied by the 'Optimal Foraging Theory'. Thus, the latter has been applied to humans and labeled "Human Behavioral Ecology" [15], a formalist approach which is nevertheless controversial

<sup>3</sup>E.g. leafcutter ants cut and process fresh vegetation (leaves, flowers, and grasses) to serve as the nutritional substrate for their fungal cultivars. These leaf-chewing ants are belonging to the two genera *Atta* and *Acromyrmex*.

<sup>4</sup>And until at least the industrial revolution.

[16]. Second, how can we explain the transition from foraging to farming, i.e., the so-called “Neolithic Revolution”? [4,17]. Third, why despite the invention of agriculture, some societies of hunter-gatherers have persisted and how do modern hunter-gatherers manage to retain their collective identity in a mixed economy, now obtaining some resources through means beyond foraging? [18-21].

It should however be noted that although foraging is the central feature of hunter-gatherers societies, foraging is a human behavior which exists in various human societies, not only in hunter-gatherers societies.

### Which wild resources are foraged?

Third, from a technical point of view, foraging is the extraction of natural resources, whatever they are used for, e.g. for subsistence - that is to say supporting oneself at minimum level - or for trade, recreational purpose, cultural and ecological goals. Because there is a broad range of natural resources, foraging applies to a narrow range of natural resources, due to three restrictions that are implicit in the literature on foraging. At first, natural resources are restricted to renewable natural resources. In other words, foraging only concerns plants and animals, terrestrial as well as aquatic, i.e., minerals are excluded. Such restriction should in fact be qualified because, for instance, prehistoric foragers were collecting some minerals (e.g. flint) to make tools or for pigments. They were collecting them either directly on the ground, i.e., without mining, or by mining, i.e., by excavating large holes in the ground. Nowadays, some people are still foraging minerals (coal, salt, ochre...) by using either of both techniques. Thus, while they are usually excluded from the list of potential foraged resources, minerals should be included into this list. Second, among terrestrial plants, foraging is limited to Non-Timber Forest Products (NTFPs). This is so because logging activities can be considered as a form of cultivation, i.e., of resources production. One could note that timber can be cleared by people that have had no involvement in the planting or maintenance of the trees, i.e., timber can also be foraged. In many developing countries, for instance in Madagascar, many people are still foraging timber of the primary forest to get precious woods or simply to make charcoal. NTFPs include all biological materials, except timber, that are found in the forest, such as wild food plants, honey, resin, spices, wildlife products, fuel wood, charcoal, and raw materials for handicrafts, such as rattan, vines, bamboo, and grasses. It should be noted that NTFPs can also be collected in urban context [22]. Finally, foraging is assumed to be a non-industrial activity, i.e., it requires a minimum level of investment and does not lead to massive extraction of natural resources. However, it is not because some activities are large-scale or industrialized (e.g. fisheries or mining...) that they should be excluded of foraged resources.

We have previously demonstrated that the three restrictions about foraged resources which are implicit in the literature about foraging should be challenged. Indeed, foraged resources are theoretically not restricted to NTFPs; they should include non-cultivated timbers as well as minerals. Furthermore, the extent of foraging should not be limited by the scale of the foraging activity nor by the technique - home-made or industrial - used to extract resources from the wild. In fact, these three restrictions come from the fact that foraging is most of the time associated with foragers and the latter are often assimilated to hunter-gatherers. Even though it is too restrictive to limit the resources that can be foraged to NTFPs, we make - only for simplicity reason - such assumption in the sequel of the present paper.

As a remark, it should be noted that when the quest of food for

subsistence is concerned, foraging is implicitly restricted to edible natural resources. Because in the sequel we will consider foragers' goals which may be different from subsistence, we will assume that human foraging behavior is applied to edible and non-edible resources.

### Is the extraction of wild resources a particular economic activity?

Fourth, foraging is an economic strategy per se and it is an alternative to production. Because renewable natural resources have their own natural rate of growth, foraging is an economic activity characterized by decreasing returns. Moreover, if the intensity of foraging is excessive - compared to the rate of growth of natural resources - it may reach the carrying capacity of these resources and therefore lead to their depletion or extinction.

One additional central issue with respect to foraging is the access to land and thus to resource habitats. In the pre-modern (or pre-capitalist) world, foraging was associated with common property regimes. In the capitalist world where exclusive property rights have been generalized (especially in developed countries), common property regimes are scarce; therefore public lands constitute the most potential sites for foragers because of their generally open terms of access. However, and in addition to explicit closures of land, regulations - such as season limits, permit costs, equipment restrictions, and prohibitions on harvesting specific plants or animals - pose barriers to human foraging behavior.

### Biological Goal: Foraging to Ensure Self-Subsistence

Subsistence patterns are the ways in which societies transform the material resources of the environment into food. The major human subsistence strategies are foraging, pastoralism, horticulture, agriculture and industrialism. Foraging relies on food naturally available in the environment. Until the industrial revolution there were three major variations of the foraging subsistence pattern: pedestrian, equestrian and aquatic. Subsistence means supporting oneself at a minimum level; thus a subsistence economy is a non-monetary economy which relies on natural resources to provide for basic needs. According to Emery and Pearce [23], in the sequel we understand subsistence as any direct use of natural resources to meet the requirements of material and cultural survival outside the formal market.

### Simple hunter-gatherers

Simple hunter-gatherers correspond to all people that were living during the glacial period, i.e., before the Pleistocene-Holocene transition. Some of the post-glacial foragers, including those who are still living nowadays - can also be considered as simple HG. They coincide with the vision of HG societies which was dominant until the 1960's. Indeed, until the 1960's, HG societies were mainly - or exclusively - seen from Hobbes' [24] perspective who claimed that before the appearance of modern governments and states, life was “solitary, poor, nasty, brutish and short”. Such vision has been persistent among academics at least until the 1960's [25]. According to this view, the economy and society of HG - thereafter called “simple HG” - are described by four features. The main one is that people were foragers. They were roaming all the time to get their food because their technology, hunting and gathering, provided low productivity and wild resources were scarce. Food was consumed on the spot or soon after, i.e., foragers were living in an immediate-return economy (Woodburn)<sup>5</sup> [26]. Their technology

<sup>5</sup>While in delayed-return societies, food and other resources might be stored for months or years, with marked effects on social organization and cultural notions of property, leading to the so-called “complex HG”.

also constrained them to have a nomadic way of life in order to avoid starvation. Since they were nomads and resources were scarce, their population had a low density and they were organized in small groups or “bands”. Due to their deficient technology and the lack of division of labor – except the one based on gender - their society was assumed to be egalitarian. Until the 1960’s, most people agreed with this vision for many reasons. Despite the epochal changes of the last century, features applicable primarily to simple HG societies, identified in the decades before and since the 1960’s, have held up remarkably well [18]. Indeed, until recently and even nowadays, some tribes or peoples are still considered as “simple foragers”, e.g. Australian Aborigines, African hunter-gatherers (!Kung, Hadza, Mbuti..).

### Complex hunter-gatherers

The Mesolithic period started around 12.000 BC and has ended few millennia later with the introduction of agriculture. It started with the end of the last ice age, i.e., with the transition from the Pleistocene to the Holocene. This transition was due to a warming climate which led to the melting of the ice, the rise of the sea level, an increased number of rivers and lakes and the diversification of ecosystems. In some circumstances, the ecosystems were now rich, i.e., characterized by edible resources which were locally abundant – seasonally or annually. This change triggered the development of hunter-gatherers societies who have been labeled as “complex” [27-30]. This complexity is defined in terms of “increases in societal size, scale, and organization...with indices such as new technology, specialized production, occupational and status differentiation, sedentism and low mobility” [27]. Indeed, due to the abundance of food resources (wild cereals, marine resources, acorns, snails...), whereas they were still foragers, people of these societies have been able to develop as farming societies did from the Neolithic period. Among these locally abundant wild resources allowing the existence of complex societies of hunter-gatherers, marine resources (anadromous fish, sea mammals, shell fish) are by far the most important. In fact, early Holocene forest expansion across Europe would have resulted in a substantial reduction in carrying capacity for human populations reliant on hunting and gathering. In some areas of Europe the reduction in animal biomass was compensated for by the availability of aquatic resources in inland rivers, lakes and wetlands. Thus, across Mesolithic Europe as a whole there was a trend of increasing exploitation of aquatic resources against the background of early Holocene forest expansion. This trend is seen in site distribution patterns and archaeofaunal inventories, as well as in C- and N-isotope values of human remains, to the extent that later Mesolithic populations in many parts of Europe are perhaps more accurately characterized as ‘fishers’ rather than hunter-gatherers.

Worldwide, some of these societies of complex HG persisted during the Mesolithic (e.g. the Natufians, in the Levant - Bar-Yosef, 1998; the Jomon culture, in Japan) [31], during the Early Neolithic (e.g. the Ertebolle culture, Northern Europe – Svizzero [32], the Middle Neolithic (e.g. the Pitted Ware Culture, Scandinavia – Svizzero [33] and even beyond. The early Europeans who settled in North America from 1500 AD have discovered American native societies in which subsistence was entirely based on foraging (on the Northwestern coast of America – e.g. the Kwakiutl - as well as on the South coast of California – e.g. the Chumash) whereas agriculture was present in some areas of this continent for centuries and even millennia<sup>6</sup>.

Thus, when food resources are locally abundant – and if in addition these resources can be stored [26,34] – human foraging behavior is persistent because it leads to a sustainable way of life in which labor productivity can be even higher than in farming activities.

### Non-marketed mixed economies

During its early ages, agriculture was for sure a risky activity. Indeed, the first farmers have experimented a trial and error process [35]. Moreover, when agriculture has spread to other regions, the first farmers have also had to adapt animals and cultigens to various climates and biomes. Given these difficulties associated with the introduction and the spread of agriculture, it was likely that first farmers’ crops fail or that their flocks die due to disease or food shortages. Therefore, early farmers have maintained some foraging activities in addition to their farming activities. The combination of foraging and farming defines what are called “mixed economies”. Among these economies, some have been labeled as “low-level food production” [11], and defined as a 30–50% dependence on domesticated plants and animals, the remaining food being derived from hunting and gathering. Such mixed economies have in fact existed from the Neolithic period to nowadays. In fact, low-level food production was probably only a stable and successful long-term socioeconomic solution when environmental limitations offered little chance of agricultural intensification. Indeed, many ethnographic cases of low-level food production involved previous farming populations who crossed environmental limits into agriculturally marginal zones [36].

Thereby, in areas that are not well suited for a sustainable development solely based on agriculture, mixed economies seem to be the rule, i.e., foraging behaviour provides the food resources which help to complement the resources provided by agriculture.

### Poverty and hunger

In all periods and in all places, it is possible that foraging wild resources is the unique option some people – the poor – have in order to get their subsistence. Such situation still exists nowadays in developing as well as in developed countries. Indeed, a recent study<sup>7</sup> claims that “The livelihoods of over 1.6 billion people depend on forest goods and services for subsistence”. In particular, wildlife is the primary source of animal protein and income for more than one billion people worldwide. For example, wild-meat consumption is important for the food security and nutrition of people in the Congo Basin in Central Africa, where 60 percent of the population lives in rural areas and subsists on natural resources.

In developing countries, populations living near or in forests have a long history of Non-Timber Forest Products (NTFPs) extraction for sustenance or sale. As implied in the term, NTFPs include all biological materials, except timber, that are found in the forest, such as wild food plants, honey, spices, wildlife products, fuel wood, charcoal, and raw materials for handicrafts, such as rattan, vines, bamboo, and grasses. In this section we focus our attention on NTFPs that are not marketed and consumed by local populations in order to ensure their subsistence<sup>8</sup>. Indeed, in many resin, communities NTFPs that are directly consumed play a more important role in the livelihood of the population than the cash earned with the sale of NTFPs or other commodities. For instance, Delang [37,38] uses two methods of evaluation to estimate the value of the wild food plants consumed by Pwo Karen people living (in 2004)

<sup>6</sup>Prior to colonization about two-thirds of North America was occupied by hunters and gatherers, including most of what is now Canada and much of the United States west of the Mississippi [19].

<sup>7</sup>Provided by the Advisory Group on Finance - Collaborative Partnership on Forests [39].

<sup>8</sup>Marketed NTFPs are studied in the next section.

in the Thung Yai Naresuan Wildlife Sanctuary in western Thailand<sup>9</sup>. The first method calculates the time needed to gather the wild food plants. The second method uses the prices of commercial substitutes in the market to estimate the number of days household members would have to engage in paid work if they switched to commercial food crops. This author concludes that for Karen the gathering of wild food plants seems to be a very efficient method of subsistence. The alternative, engaging in wage labour (or growing cash crops) to earn the money necessary to buy comparable food plants in the market, would require almost ten times more work.

Foraging in order to ensure subsistence and survival also exists in developed countries and even in the (today) first economic power country<sup>10</sup>. As stated by Emery and Pearce [23]: “there are quite reasonable grounds for astonishment, even incredulity, that in the United States today there are people who hunt, fish, trap and gather in the nation’s forest to provide their survival”. Such behavior is present among populations living near or in forests but also near or in cities. In fact, in many countries (developing as well as developed), increased urbanization and migration has caused shifts in the harvesting of wild products. Usually, urban foraging is rarely for self-sufficiency, it is instead a method of identity creation. However the urban poor frequently participate in wild harvesting to fulfill both cultural and economic demands, using traditional ecological knowledge to participate in an urban economy with high barriers to entry.

In these circumstances, foraging is not the result of the existence of abundant food resources present in the wild (as it is for complex foragers), nor the consequence of unsustainable agriculture systems due to unfavorable climatic or ecological conditions (as it is in mixed economies). Nowadays, it is sure than in any developed country (and in most developing countries), most basic needs – especially food – can be met fully in the market. Therefore, if some people are still foraging in order to get their subsistence, it is because they are excluded from the market, i.e., they have no (or insufficient) income or jobs. In other words, many poor people (whatever the epoch they lived) are foraging in order to ensure their subsistence because they do not have alternative strategies; they are thus in a situation similar to that in which were pre-Neolithic hunter-gatherers [40].

### **Economic Goal: Trading Foraged Resources to Supplement Income**

Most foragers are not self-sufficient for their subsistence, i.e., they get part of the food they consume from relationships with “others”, i.e., with people who are not foragers. Besides the trade of wild products, the complexities of their economic situation are compounded by the addition of such diverse activities and income sources as migrant labor, government welfare payments, royalty payments for mineral rights, as well as receipts from tourism and craft production [18]. For many foragers, harvesting wild products is either a way to directly ensure (only) part of their subsistence or a secondary source of income. With the worldwide spread and the increased intensity of the economic globalization process, especially from the mid-twentieth century, most foragers - if not all - are living in marketed mixed economies. Moreover, all have experienced the transformative effects of colonial conquest and incorporation into states. This means, on the one hand, that foraging activities do provide only part of their subsistence, and

<sup>9</sup>The area designated as wildlife sanctuary has been inhabited for over 200 years by the Pwo Karen, and is now home to approximately 3500 Pwo Karen (the Pwo Karen are an ethnic minority group located in Thailand and Burma).

<sup>10</sup>Here we consider subsistence activities based on foraging which exist outside any legally guaranteed rights such as the ones existing in Alaska, Hawaii and for American Indian tribes.

on the other hand, that foragers have contacts with non-foragers throughout the market from which they get income (e.g. by selling the wild products they harvest) and buy various consumption goods. In other words, there are multiple facets of the ways foragers’ activities articulate with the formal economy. It is therefore more illuminating to understand human foraging behavior as the product of, on the one hand the dynamic of the foraging way of life itself and on the other hand the dynamic of their interaction with non-foraging neighbors and the dominant state administrative structures. What is therefore important here is to identify the reasons explaining the changes of foragers’ goals, i.e., why foragers who were harvesting wild products for their own subsistence have decided afterward to forage in order to get a secondary or even a primary source of income?

### **Marketed mixed economies**

Nowadays most foragers are living in marketed mixed economies and this is even true for the well-known African! Kung or Ju/hoansi who were until the 1960’s considered as hunter-gatherers living in an “affluent economy”. Indeed, since the late 1970’s, they are living in a very mixed economy with cash. They<sup>11</sup> now obtain 18% of their daily calories from hunting, 8% from gathering, 1% from gardening, 35% from store bought goods, and 38% from government rations [41].

In other places all around the world, hunting, fishing, and gathering are mobilized when incomes (or wages) are not sufficient to meet household’s needs.

### **Foraging for exchange**

Historically, trade precedes market exchange in the capitalist economy and is probably as old as humanity is. So, foragers living in all epochs have been able to trade. During the pre-Neolithic period, trade was probably restricted to few products, especially to luxury items such as jewelry and ornaments. From the Neolithic period, the extent of trade has grown large, due to increases of the population size, the intensity of the division of labor, the production of agricultural as well as handcraft products, the improvement of transportation techniques (...).

In many different places, and especially in South and Southeast Asian, foragers have lived - and are still living - in degrees of contact and integration with non-foraging societies. They are linked to settled villagers and their markets, trading “forest products” (e.g. furs, honey, medicinal plants, bamboos and rattan) for rice, metals, and consumption goods. Some of these arrangements have persisted for millennia. What is therefore important here is to identify the reasons explaining the changes of foragers’ goals, i.e., why foragers who were harvesting wild products for their own subsistence decide to forage and to trade wild products? Three salient factors may explain this evolution of foragers’ goals [20]. Their common thread is that while foragers are involved into particular relations to the natural world, it should also be noted that they are always involved in relations (of power, affect, interdependence and sometimes dependence) with others, i.e., with non-foragers.

First, it is possible that basing its entire subsistence on foraging might have been difficult in certain environments (e.g. in tropical forests where soils are eroded by heavy rainfalls). However, sometimes such environment was sufficiently well endowed with specific natural resources (plant<sup>12</sup>, animals or minerals) which were – at some point of the time – (highly) desired by non-foragers. Thus, it is the incentive

<sup>11</sup>These data’s come from! Kung peoples of the Xamsa village, Namibia.

<sup>12</sup>E.g. precious woods or spices.

of reciprocal exchange which made some forager-trader lifestyles possible. Moreover, far from representing the rather exotic activity of marginal peoples, foraging in particular has played a historical far greater role in the European colonial expansion, the specialization, and the development of several South and Southeast Asian states, as exemplified by the impact of trade of precious woods (Sappan wood, scented wood...) or spices (pepper, clove, cardamom, nutmeg...).

Second, it is often believed that foraging has persisted in areas that were not suitable for agriculture. Although this claim is true in many contexts<sup>13</sup>, it can also be challenged. Indeed, the development and the spread of agriculture has modified the landscape (e.g. the construction of irrigated terraced rice fields), including soil, vegetation, wildlife habitat and access to water. Such modifications require substantial changes in foraging practices of people who use a landscape containing such transformed contexts. In other words, the spread of agriculture has not necessarily led to the exclusion of foragers. Indeed, human-environment interactions<sup>14</sup>, for instance in early agrarian societies, did not necessarily have negative effects on ecosystems and biodiversity [42]. In the long run, woodland openings and the establishment of arable fields created many new habitats for plants and animals that in turn led to increases in the biodiversity of weed species and advantaged many other taxa such as saproxylic invertebrates, many of which flourish in open forest habitats. Occupational history is therefore as important as environmental context in explaining changes of foragers' goals. Although most of the time agriculture implies foragers-farmers competition, it may also lead to cooperation between both groups. The latter occurs when the environment – even when it has been transformed by farmers – contains wild resources desired by farmers (or 'others') and which can be harvested by foragers and exchanged through trade relationships.

Third, the continuing importance of foraging (especially in Asia) requires a fine balance of proximity and distance between foragers and others. Indeed, foragers emerge as specialists in resource extraction when desired wild resources are clustered, especially in remote areas (with difficult access and perhaps less suitable for cultivation), and where their exploitation requires developed local ecological knowledge.

### Poverty alleviation and economic development

It is often believed that foraging should be encouraged in developing countries because trade in NTFPs would reduce poverty while promoting the conservation of the forests [43]. The fundamental idea behind the advantages of the trade of NTFPs is that the forests are home to poor people who have an incentive in cutting them. If they could earn higher incomes from the sale of NTFPs rather than from the sale of timber or from alternative uses of the forest, then they would tend to conserve it [44]. Initial optimism was followed by skepticism and subsequently by pessimism, i.e., it became obvious that it was not possible to establish a sustainable economic development on a economic system mainly based on foraging [45-47]. Indeed, the optimist belief has been contradicted given any of the three following reasons [37,38]. From an economic point of view, a sharp increase in the supply of NTFPs in local markets with limited demand would result in a drop in prices, which would invalidate the initial calculations about the potential profits that NTFPs could generate to forest dwellers. From an ecological point of view, a market for NTFPs might contribute to their over-collection, which eventually results in environmental

<sup>13</sup>With the spread of agro-pastoralism, foragers were only able to survive independently in those areas of less value to food producers, such as areas of low or unpredictable rainfall, dense tropical forest, or frozen Arctic wastes.

<sup>14</sup>Such claim is even true for human-environment interactions including non-agriculturalists, e.g. miners, foresters, prospectors, states, royal courts (...).

degradation, deforestation and loss of biodiversity. From a social point of view, two issues in particular prevent the poorest members of forest communities from becoming successfully involved in the marketing of NTFPs. First, the extraction of NTFPs sometimes requires specialized equipment that the poor cannot purchase. Second, the poor sometimes do not have the status and power to control the lands and/or resources that generate the highest potential profit.

Despite the three reasons previously mentioned, recent studies tend to prove the contrary. Indeed, from 101 NTFP ecological studies, Stanley et al. [47] demonstrate that “nearly two-thirds of research (63.3%) reported that extraction was sustainable or likely to be so, compared to less than one-fifth (17.8%) that found it to be unsustainable”.

### Increased autonomy?

The Kalahari Debate is a debate that began in the 1980's amongst scholars about how the San people and HG societies in southern Africa have lived in the past; it opposes “traditionalists” (or “isolationists”) to “revisionists” (or “integrationists”) [48]. Traditionalists consider the San to have been, historically, isolated and independent foragers separate from nearby societies. The revisionists believe that the San have not always been an isolated community, but rather have played important economic roles in surrounding communities. Proponents of this school see contemporary foraging peoples more as victims of colonialism or subalterns at the bottom of a class structure than as exemplars of the foraging way of life. This revisionist view sees the foragers' simple technology, nomadism, and sharing of food as part of a culture of poverty generated by the larger political economy and not as institutions generated by the demands of foraging life.

The general point to be made is that outside links do not automatically make foragers subordinate to the will of their trading partners. Exchange is a universal aspect of human culture; all peoples at all times have traded. In the case of recent foragers, trading relations may in fact have allowed foraging peoples to maintain a degree of autonomy and continue to practice a way of life that they valued. Therefore, foragers believe in their way of life: foraging for them is a positive choice, not just a result of exclusion by the wider society. Indeed, a common theme among foragers-traders is to see the forest or the bush (or more generally what they consider to be their territory) as a refuge in which they go after their trading activities. However, beyond trading relationships, foragers are also impacted by several outside forces (such as dam construction, logging, mining, rain forest destruction, bureaucracies, missionaries, and land alienation) which restrain the habitat of the wild resources they harvest and thus may reduce their autonomy.

### Socio-Cultural Goals: Foraging to Claim Beliefs and Values

In the two previous sections, it was – implicitly or not - assumed that if foraging was the main or the central activity of some people, such result derived from a least-cost assumption. In other words, people will always cling to foraging if they can because it is easier and more reliable than other activities. Although such insight still has much analytical value, foragers' goals can also be grounded on non-economic or socio-cultural foundations.

### Culture, heritage and identity politics

The motivations of human foraging behavior can be also found into the cultural component of wild resources. Indeed, the valuation

of these resources is not necessarily monetary, as they are embedded within social structures and cultural practices. In other words, instead of focusing upon the income generated by foraging, foragers can be envisioned as participating within networks of social and cultural relations from which its meaning and value are derived. Although these activities have special cultural value to indigenous peoples, they are also important to individual from a variety of ethnic backgrounds [23]. Group identity can be constructed through participation in certain types of work, especially during times of change, such as the influx of urban migrants to rural locales. Some practices – such as sweet grass basketry weaving - occur outside of the formal market, and function as a method of the social reproduction of identity and heritage, thus as a form of contemporary subsistence. However, cultural motivations are often integrated within economic and subsistence concerns in rural contexts.

Even though some people previously considered as “true” hunter-gatherers, such as the !Kung, they now get most of their food from sources other than foraging. However they still hunt and gather very regularly and almost all are familiar with local resources [41]. In fact, many other HG bands living nowadays behave as the !Kung do: they still hunt and gather regularly, or they have a relationship with someone that does, and almost all know how to hunt and gather. They are still prepared to survive in the absence of certain sources of food [29,49]. Such behavior demonstrates that people hunt and gather not just to eat or to get income, but to maintain the order of social relationships emphasizing egalitarianism and collective appropriation of resources. Since the status of forager groups in several countries has declined so seriously, the contemporary hunter-gatherers (especially in Africa) [50] are now more seen through their contributions to civilization, and their attempts to preserve or rediscover their political and cultural identities.

### Recreational values and wildlife tourism

Throughout history, humans have relied on renewable natural resources for their sustenance. With the advent of industrialization and urbanization, however, society has become increasingly less dependent on the harvest of wildlife for sustenance, and recreational values have gradually replaced subsistence as the primary motivation for engaging in hunting, fishing and gathering activities. Even though fishing and hunting are simply immersion in an elemental behavior, ingrained in our genes through millions of years of evolution, from an evolutionary perspective it was essential for our primal nutritional needs, and it is always sure to give us a thrill, a moment of excitement, pride in our skill, and the feeling of achievement.

Concerning hunting, some scholars even claim that, from the Neolithic period, it is possible that it became a marker of social status [51]. Within feudal Europe, urban forests were used for lumber and biofuel, with most originating as reserved as hunting grounds for the local ruling elite. Nowadays in North America and Europe, recreational hunting produces food for consumption and serves also as a population-regulation function. Many rural landscapes in these regions are composed of agricultural lands and production forests in which large predators have been eradicated. Hunting is a low-cost method of maintaining wildlife populations (e.g. large ungulates and suids) at levels within ecological and social carrying capacities, and of conserving habitats favorable to wildlife. Urbanization is proceeding quickly and more and more people live far removed from nature: yet all over the world there are peoples who are still depending upon wildlife for survival, and their interactions with nature and wildlife form important elements of their cultures and lifestyles. Traditional

and recreational hunting supports the livelihoods of them.

The increasing urbanization of society, combined with the extensive range of quarry, has created a demand and supply situation in which various strategies have been pursued to provide client-foragers with their desired experience, and to derive profit for the fishing and hunting industry and tourism. Although not required for subsistence, hunting and fishing for recreation play an important role in the economy of western countries, and may even bring significant commercial benefits, as well as in African countries<sup>15</sup>. In other words, hunting and fishing industry and wildlife tourism create incentives (through marketing) which foster human foraging behavior [52].

Besides hunting and fishing, gathering of non-wood forest products (NWFPs) is still developed. For instance, the practices of berry and mushroom picking are still prevalent throughout Europe and North America. NWFPs are goods of biological origin other than wood derived from forests, other wooded land and trees outside forests. They may be harvested in forests and agro-forestry systems and from trees outside forests. Examples of NWFPs are foods and food additives (e.g. edible nuts, mushrooms, fruits, berries, herbs, spices and condiments, aromatic plants, and insects), fibers (e.g. bamboos and rattans), and medicines, cosmetics and cultural products (e.g. resins, gums and dyes).

### Urban foraging and ecology

Within an urban context, the term “forager” is used to describe the people who collect wild plant materials (herbaceous plants, fungi and trees). More specifically, foraging is the practice of harvesting non-cultivated plants for food, medicine, floral and greenery, craft products or other purposes, for personal use or sale. Urban NTFPs include entire plants, plant parts (e.g. seeds, cones, leaves, flowers, and fruits) and plant exudates, as well as fungi, mosses, and lichens. Honey and wood products other than timber (e.g. firewood, poles, and specialty woods for crafts) are also included in the definition of NTFPs, but are excluded from consideration animals, fish, shellfish, or insects.

Within an urban context, foraging frequently occurs in parks, along trails and waterways but can also include gathering from lawns and more highly urbanized spaces [53]. Many municipalities and urban planners reject deriving products as a legitimate function of urban forests. This raises a number of social justice questions, namely who has access to the natural resources in the city? According to Poe et al. [54], “An urban forest justice framework...recognizes the rights of urban people to control their own culturally appropriate food and health systems based in cultures of gathering wild edible and medicinal plants and fungi”. A particular form of urban foraging is called “dumpster diving” It is a popular form of modern salvaging of waste discarded in large commercial, residential, industrial and construction containers. People may often dumpster dive for useful items such as clothing, furniture, food, and similar items in good working condition. Even though the items in good working condition that have been discarded by their owners are not “wild resources” per se, dumpster diving can be viewed as an effective modern foraging technique. Indeed the foraged resources are a part of the environment in which the individual forager had no role in the production of these resources.

Through the harvesting of plants for personal use, people are able to be more directly connected to sources of local food and medicine. In addition, foraging is an activity which can build community and intergenerational bonds, inspire exercise, serve as a supplemental source of income, and offer a way for people to connect to nature [54]. In other words, urban foraging is underpinned by interconnected <sup>15</sup>E.g. Safari hunting and trophy hunting.

and multiple notions of identity, place, mobility, and agency for both humans and more-than-human interlocutors [55]. The harvesting of plants is also directly connected with issues of conservation and sustainability. If we hypothesize that there is a decreased likelihood that foragers are gathering products to sell on the formal market as a main source of income, thus placing the practice of urban foraging within the realm of daily life, this opens up a vast array of motivations to participate in urban foraging practices. Motivations may be such as but not limited to protesting the industrial food system, culinary adventure tourism, seeking greater understanding of local environments and sustainability, economic need, connecting to personal histories and identities, and re-learning outdoor wilderness survival skills. Poe et al. [54] have analyzed foraging behavior of wild plants from the urban forest in Seattle. Some of their main findings are that harvesters are diverse in their demographics, practices, and their use of spaces; social benefits and values are major motivating factors; wild foods and medicines are the most frequent use of wild plants.

## Conclusion

Foraging, i.e., the method used to get food, is a ubiquitous behavior among animals, including humans. For the latter, foraging is motivated by various goals associated with relative weights which have evolved with the passage of time. Indeed, the goals of human foragers are influenced by the historical, the sociological as well as the ecological contexts. In an historical perspective, foragers were initially hunter-gatherers. Their main motivation was to satisfy their basic or nutritional needs. Such biological goal has progressively vanished with the advent of agriculture. However, from that period to nowadays, such goal is remained intact for some people, i.e., for people without job or income who must foraged wild resources in order to survive, i.e., to ensure their subsistence. For most people who remained foragers after the introduction of agriculture, their biological goal has been progressively replaced by an economic one. Indeed, these people, called “foragers-traders” have continued to harvest wild resources, sometimes also for their self-consumption, but mainly in order to sell these resources on the market. Thus, for them the extraction of wild resources has become an economic activity implemented in order to get income. While “pure” foragers or hunter-gatherers have nearly disappeared during the last decades of the twentieth century, foragers-traders are still present worldwide and some groups of them are even growing large. In addition to the biological and the economic goals, a socio-cultural goal has always been present in forager’s societies. Indeed, throughout its techniques and rituals, foraging contributes to the construction of social identity and the reinforcement of social networks. Recreational motives, associated with various foraging techniques, such as hunting, fishing or mushrooming, have been present among foragers for a long time ago, even though some of these practices were (and still are) restricted to foragers belonging to the elite. The increased importance associated to entertainment in contemporary people’s preferences has led to the development of recreational activities – such as wildlife tourism – entirely based on foraging. The increase of human population and the growing urbanization which have developed during the last decades have led to the expression of a new type of foraging, namely urban foraging. Such practice encompasses various motivations, which can be biological or economical, but the main one is ecological, i.e., the wish to commune with the nature.

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Citation: Svizzero S (2016) Foraging Wild Resources: Evolving Goals of an Ubiquitous Human Behavior. *Anthropol* 4: 161. doi:[10.4172/2332-0915.1000161](https://doi.org/10.4172/2332-0915.1000161)

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